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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Twenty-Fourth Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY, LYNN, MASS., Jan. 18, 1894.

The twenty-fourth annual meeting of the New England Association of Gas Engineers will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 21st and 22d. The meeting will be called to order at 10 o'clock, Wednesday morning.

A general invitation is extended to members to contribute to the interest of the meeting by papers or questions for the Question Box.

A list of the papers and questions to be considered will be published later.

C. F. PRICHARD, Secretary.

BRIEFLY TOLD.

THE ANNUAL MEETING OF THE NEW ENGLAND ASSOCIATION.—The fraternity will now consider beyond peradventure that the gas-making year of 1894 is well upon them, for here they are confronted with the official notification that the New England Association is getting ready for its 24th annual assembly. One prominent thing in connection with Secretary Prichard's announcement is the numbering thereof, for it cannot be gainsaid that the Mother Association is fast attaining to the age of matronship, since certainly there is nothing especially juvenile, in these days of quick maturing, in the admission that four-and-twenty years have been recorded. However, the New England Association, having grown in grace, has not outlived the purpose of its founders, and so it stands to day as it stood in its first day—typical of advance and progress. No inharmonies have caused discord within it, and the voices that sounded its keynote are still resonant and guiding. To come to plain, everyday consideration, though, it might do to remark that the prospects this year for a successful meeting are very bright. Last year the country over was, at this time, in the grip of the ice-king, and the time of the average superintendent was in no sense his. Broken mains, choked services, and the like, kept him on the "go," wherefore he had no time or disposition to think of Association meetings, much less to consider the fact of preparing a paper for the benefit of his fellows, but this season no such formidable obstacles present themselves. In fact, it is quite the reverse, because in addition to a comparatively "open winter," the average superintendent finds himself confronted with the anomaly of a decreasing business. To be more precise, rather, to be closer to accuracy, he has found that condition existing in the months of November and December, and partly in the present month; but now the conditions seem to be changing. The gas barometer shows a return to the normal, particularly since January 10th, when cloudy weather and an undoubtedly smart gain in the belief that the worst has been seen, has caused smiles to take the place of the frowns with which we were becoming all too familiar. The absence of the distressing weather conditions of a year ago, added to the greater comparative leisure of the book-making gas man, ought certainly make him pay due heed to Secretary Prichard's invitation "to contribute to the interests of the meeting, by papers or questions for the Question Box," and we have no doubt that the invitation will be accepted by many in a practical way. This year, too, the Association will hold its closing session on Washington's Birthday, and that holiday intervention ought to be the cause of exceptionally good attendance. As usual, the meeting place will be in Young's, and we are quite sure that President Nettleton will preside over a meeting the equal in numbers and interest of any of the many enjoyable ones that make up the New England Association's records.

TO SECURE FAIR PRICES FOR TAR.—Following the attempt made by Mr. E. H. Jenkins, of Columbus, Ga., to inauguarate a movement looking to the regulation of prices for gas tar in the South, on a basis somewhat approaching the real value of that useful material, comes the news that the Tar Committee appointed at the last meeting of the Ohio Association has formulated a plan which has the merit of being practical in every sense. In our next issue we will print full particulars of

that which the committee recommend, and were prevented from printing the details in the current issue only because of the late day on which the same were received. The schemes proposed look to us to be perfectly feasible, and the means whereby the necessary capital is to be secured are simplicity itself. The committee naturally propose to confine themselves, in their present attempt, exclusively to the tar product of Ohio, but if their scheme is a success—and we fully believe that it will be successful—it will be merely a matter of choice for the gas makers of other States to follow in their lead.

NOTES.—Mr. Frederic Egner has accepted an appointment as Superintendent of the gas and electric light plants of the City Gas Light Company of Norfolk, Va.——Mr. C. J. Hayes, Superintendent of the Palatka (Fla.) Gas Light and Fuel Company, has been appointed Receiver for the South Florida Gas and Electric Light Company, of Orlando, Fla.——The Directors chosen by the Pulaski Gas Light Company, of Little Rock, Ark., are: Messrs. J. A. Fones, C. F. Penzel, John G. Fletcher, C. M. Taylor, R. A. Little, Philip Pfeifer, and S. M. Appleton.

SOMETHING OF INTEREST FROM CENTRAL NEW YORK.—"C. P. R.," writing to the JOURNAL from Geneva, N. Y., under date of January 16th, says: "I forward some notes respecting gas matters at Auburn, N.Y., which I think will prove of interest, in that they show how the gas men there gained a victory in the street lighting contention which has have going on there for some time. The controversy dates back to May, 1892, when proposals were asked for lighting the streets of Auburn. At that time the Gas Company put in a bid for lighting by electricity below that which the electric light company asked for the same service. By virtue of its bid being the lowest, the Gas Company should have been awarded the contract, but the electric light people went before the Council and pleaded that in the event of their being deprived of the contract they would have to close up their plant and remove from the city. This action, they claimed, would give the Gas Company a monopoly of the lighting business, and hence would be adverse to the public good. The award was withheld until the beginning of winter, when the Council finally decided to give the contract to the Gas Company. Owing to the lateness of the season the Gas Company decided that it would not be advisable to install an electric plant, and a reasonable time having elapsed since it made the proposition, it declined to execute a contract on the basis originally proposed. As a result, the Council entered into a contract with the electric light people, accepting the terms of their original proposal. Under this arrangement the city was to be supplied with 275 arc lamps, of 2,000 candle power each, at a rate of $25,000 per annum (the maximum amount allowed under the city's charter), the lights to be turned on January 1st, 1894. An ordinance was introduced that all shade trees lining the streets of the city, the foliage of which extended a certain distance over the roadway, should be trimmed to a height of 35 feet, so as to keep within prescribed limits. Of course, this raised a howl from those who prided themselves on their beautiful shade trees; but notwithstanding their protests the ordinance was put into effect. The meaning of the ordinance was to give the electric light people full scope and all possible opportunity for the diffusion of their lights. The result is that when spring comes Auburn's streets will present an appearance that will cause 'weeping and wailing and gnashing of teeth,' instead of the just pride that has heretofore been experienced by its citizens over their magnificently shaded streets and walks. Another stipulation in the electric light company's proposition as originally presented was that in the event of the 275 lights not lighting the territory sufficiently well, it would put up additional lights until the illumination was satisfactory to the Council. Well, the 1st of January came, and, despite the repeated assurances of the company to the contrary, the lights were not ready. The Gas Company's contract expired on the 31st of December, and not being instructed to continue, and relying upon the electric light company's ability to fulfil its promise, the gas lamps were not lighted on the 1st and 2d days of January. With neither electricity nor gas, darkness prevailed, and the city authorities, heeding the complaints made by the people at this state of affairs, lost no time in making an arrangement with the Gas Company to light the streets by gas for six days, when it was expected the electric lights would be switched on. The six days elapsed and still no electric lights. The Council then concluded that they had had their 'fill' of electricity, and unanimously decided to rescind the contract entered into with the electric light company, and at this writing gas 'rules the roost.' Along the line of the N. Y. C. and H. R. R. the majority of the gas companies complain of a decrease in consumption owing to the closing down of mills and factories. Apart from this, all report good prices for residuals and are confident of better results in '94."

Some Comments on Admiral Selwyn's Paper on "The Existing State of the Fluid Fuel Question."

By J. P. G.

The excellent paper read by Admiral Selwyn before the Pacific Coast Technical Society, on "The Existing State of the Fluid Fuel Question," published in the AMERICAN GAS LIGHT JOURNAL of the 1st inst., was ably criticised by the members of the Society, although much of what the writer stated can be substantiated by sufficient evidence. There were, however, two or three statements which deserve special criticism.

It is stated that the calorific value of coal is, theoretically, nearly 16 lbs. of water evaporated by 1 lb. of coal. This may well be termed theoretical, because it is not in accordance with the principles of combustion as taught in all chemical text books, or with the universal practice. It is undoubtedly the fact that 16 lbs. of water have never been evaporated by 1 lb. of coal, and cannot be; 16 lbs. is practically 2 gallons of water.

The heat units of pure carbon are 14,400—say 14,500. The heat units of coal cannot be 14,500, for it is not pure carbon. Deducting the ash and other earthy impurities which go to form clinker, even theoretical heat units of coal are 13,000, but practically not exceeding 12,000. Taking the highest quantity (13,000), let us see what is the result.

It requires 1,147 heat units to convert 1 lb. of water into steam of 212° under the pressure of the 1 atmosphere; 13,000 ÷ 1,147 gives 11.33 lbs. of water converted into steam theoretically by 1 lb. of coal. Taking the heat units of pure carbon, the quantity of water theoretically evaporated by 1 lb. of carbon is (14,500 ÷ 1,147) only 12.64 lbs; while practically only 10.46 lbs., or less, is evaporated by 1 lb. of coal.

Steam at 212° in the boiler, which will theoretically develop 1 horse power, contains 37,930 heat units, and the steam evaporated from 1 cubic foot of water contains 71,548 heat units. 71,548 ÷ 13,000 gives 5.5 lbs. of coal per cubic foot, or 11.3 lbs. of water evaporated by 1 lb. of coal. If 12,000 heat units for coal are taken, we obtain 10.4 lbs. of water evaporated per pound of coal.

Again, if we adopt the method of estimating the quantity of water evaporated by the heat communicated to the furnace by 1 lb. of coal, the escaping products of combustion having only a temperature of 212°, the following results are obtained: 12.1 lbs. of water evaporated by 1 lb. of carbon; 10.85 lbs. evaporated by 1 lb. of coal having 13,000 heat units; 10 lbs. evaporated by 1 lb. of coal having 12,000 heat units.

Thus there have been obtained three similar results by as many different methods, the temperature of the steam being 212°—viz.:

1st. By the direct heat units of the fuel—
- 1 lb. of carbon will evaporate, theoretically... 12.64 lbs. water.
- 1 lb. of coal having 13,000 heat units..... 11.33 "
- 1 lb. of coal having 12,000 heat units..... 10.46 "

2d. By the heat units of 1 horse power as developed in the boiler—
- 1 lb. of coal having 13,000 heat units will evaporate..... 11.3 lbs. water.
  (Allowing for radiation, etc., 10.2 lbs. water.)
- 1 lb. of coal having 12,000 heat units ..... 10.4 "

3d. By heat communicated to the furnace by the fuel—
- 1 lb. of carbon having 14,500 heat units evaporates, theoretically ..... 12.1 lbs. water.
  (Allowing for radiation, etc., 10 99 lbs. water.)
- 1 lb. of coal having 13,000 heat units evaporates 10.85 "
  (Allowing for radiation, etc., 9.77 lbs. water.)
- 1 lb. of coal having 12,000 heat units..... 10.00 "

The assumed theoretical calorific value, or evaporative duty, of coal is oftentimes misleading and productive of financial loss; and when based upon Joule's mechanical equivalent of heat—viz., 772 foot pounds for one heat unit—it is wholly unpractical and a mere mental conception. Why? Because all the heat thus generated cannot be utilized except at a temperature of 460° below zero, or at the absolute zero of temperature. To hope for any practical result from this so designated mechanical equivalent would be as vain as to hope to reach this condition in the ether which fills the interstellar spaces and beyond any appreciable influence of the sun or of the starry worlds.

This is illustrated by a somewhat familiar instance. Quoting from Prof. Tyndall, "I have seen the wild, stone avalanches of the Alps, which smoke and thunder down the declivities with a vehemence almost sufficient to stun the observer. I have also seen snowflakes descending so softly as not to hurt the fragile spangles of which they were composed; yet to produce from aqueous vapor a quantity of that tender material which a child could carry demands an exertion of energy competent to gather up the shattered blocks of the largest stone avalanche I

have ever seen and pitch them to twice the height from which they fell."

Now, assume a granite stone 5 feet square to fall 100 feet, both of which are moderate estimates. A block of this kind and size weighs 20,625 lbs. To pitch this weight 200 feet high would require a force of 2,338,875 foot lbs. per second, which is equal to 4,252 horse powers. To convert, say, 10 lbs of ice into steam of 212° temperature requires 12,900 heat units, and there will be developed about .3 of a horse power. Comparing this with the theoretical horse power of 4,252 given above, it will be seen that the practical attainable results are but a small fraction of the assumed theoretical values.

In the paper under review there occurs the following statement: "Four-fifths of the air is hydrogen, the strongest known combustible." This is remarkable, coming from the source from which it does, and might be considered a clerical mistake were it not for the qualifying clause, "the strongest known combustible;" the well known fact being that four fifths of the air is nitrogen, which of itself has very little or no combustible power.

The Valuation of Gas Consumers.

The London *Journal* says that in these days of competition there is a tendency to push the scrutiny of each item of income or of expenditure to a very fine degree. Not satisfied with the details visible on ordinary inspection, they are submitted to a kind of mental microscope, with the result that matters which formerly attracted no attention whatever are now carefully dealt with. If such a searching examination of the expenditure side of the revenue account is found to be advantageous, something may also be done with regard to the income, albeit that this is frequently affected by factors which are beyond the control of the management. The way in which gas is used, for example, may have a more marked effect on the working expenses than any care or skill that can be brought to bear on the other side. We are continually classifying the consumption of gas as "large" or small," as "day," "summer," "all the year round," or "winter." All of these terms have their practical significance. Since a certain magnitude of operations is necessary to enable gas to be sold cheaply, either a few large consumers or a numerous body of small users are indispensable. Day or summer business is advantageous as turning the storing or distributing plant to account at times when it would otherwise be lying idle. On the other hand, additions to the demand at the times of maximum supply—such, for example, as gas heating stoves, which are very likely to be called into use during winter afternoons and evenings—mean pro rata additions to the manufacturing and storing plant. But neither of these definitions approaches the most important factor, which is that of "time." A single 5 cubic feet per hour burner, in use for a year without intermission, means a consumption of no less than 44,000 cubic feet of gas per annum, and would leave no idle time for the apparatus used for manufacturing and distributing.

Gas works plant is of a permanent character. If a million cubic feet of gas per day are required only for seven days out of the entire year, it is necessary to provide apparatus equal to the demand. In some businesses it is possible to adopt cheap temporary expedients for tiding over the busy time. But not so in gas manufacture. The apparatus once provided means a fixed charge for interest on capital, and to some extent for maintenance—apart from the number of days it is used. Gasholders or purifiers must be regularly painted; valves and other working surfaces must be maintained in fair condition; and so on. The cost of repairs and maintenance, and of interest on capital, as allotted to each 1,000 cubic feet of gas sold, will bear a rough proportion to the actual, as compared with the maximum, working capacity. In the case of plant turning out a regular quantity of gas throughout the year, an excess capacity of something like 25 per cent. would be necessary to leave a sufficient margin for standing off for repair—the maximum capability would not be more than 75 per cent. The actual working seldom exceeds one-half of this amount. So that the most valuable customer is the one who uses gas for the greatest number of hours.

Gas undertakings are further under the disadvantage of being compelled to supply at any time. A consumer may shut up his house and go away for a year, and not use a foot of gas during that period; he may put up oil lamps or electric lights, keeping the gas as a reserve against accident; but if he chooses to return at any time and light up all over the house, or if his usual appliances fail at a moment's notice, he expects and can demand a full supply. The proprietor of a gas engine expects a full pressure whenever he chooses to turn on his tap; but there is nothing to prevent him from leaving the tap closed for months at a time, if bad trade or other circumstances render such a course advisable. A consumer can fit up gas fires in every room in the house, and demand a service and meter equal to their supply; but he need not use them for one hour throughout the year, if he does not desire to do so. Over a large area, however, these individual contingencies are not felt; and there is a fairly regular consumption, affected only by general conditions—such as the weather or local commercial matters. It is, therefore, possible to estimate, with fair approach to accuracy, the value of any consumer.

Suppose we have four gas consumers each supplied with a 10 light meter, with service pipe of suitable size. The charge per annum for maintenance and interest would be practically the same in each case. Suppose that the first uses gas without intermission, up to the full capacity of the meter; that the second uses it three hours daily, and for lighting from dusk to 10 o'clock; that the third uses it for lighting only for a similar period in the evening, and on the average for half capacity; and that the fourth keeps it simply as a reserve for use on emergency. The full capacity of the meter is 60 cubic feet per hour; so it follows that No. 1 will use some 525,000 cubic feet per annum; No. 2, 146,000 cubic feet; No. 3, 43,000 cubic feet; while No. 4 may use none at all. Comparing examples from practice with the full capacity as indicated by No. 1, it is evident that the load factor of most of the services and meters is very low. It would be interesting to take the total meter capacity of a district, and to compare it with the actual output. The inquiry may also extend to a maximum day's output in each case. In No. 1 this would mean 1,440 cubic feet per diem; in No. 2, 570 cubic feet; in No. 3, 200 cubic feet. Or respectively $\frac{1}{365}$, $\frac{1}{256}$ and $\frac{1}{215}$ of the annual consumption. From this it is evident that, in the case of any individual consumer, a fair idea of his value to the concern may be arrived at by comparing maximum daily with total annual consumption.

When one seeks to apply this method to any particular district, the class of intermittent consumers has the effect of reducing the average. It is questionable whether the annual consumption, in practice, is ever found to run as high as 200 times the maximum diurnal output. There are public buildings, places of worship, etc., in which the gas may not be used for more than a few hours per week. There are offices in which the light is not used at all for perhaps eight months out of the year. Gas fires stand idle for about the same period. And thus it is that, in every gas undertaking, the whole plant, from the retorts to the meters, experiences a great deal of "short" and of "idle" time.

Of the four classes above instanced, the first and the last are entirely theoretical, and simply serve to indicate the extreme limit in each case. In the early days of gas lighting, the average consumer occupied a position represented by No. 3; but the day and the summer consumption, that has been so well cultivated of late, tends to raise him towards No. 2. It has also raised the small and intermittent consumer higher in the scale. The advance in this direction is largely responsible for the reductions in price of gas that have been the general rule; and one of the drawbacks suffered by small gas undertakings is the fact that, the price of their gas being necessarily higher, they have not been able to advance so far in this direction as their larger neighbors. One of the advantages of "cheap gas" is the fact that it increases the average sale per consumer.

This question has become very prominent in connection with the supply of electricity for lighting. On account of the short hours of darkness, and small demand for artificial light during the summer months, many electric light companies find themselves not only unable to make a profit, but actually compelled to work at a loss during that period. The hours of consumption are few, and the idle time is therefore large. On this account, the plan of allowing substantial discounts, not too large, but to long-period customers, has been suggested. In the United States, especially, a scale of prices is fixed upon that varies according to the number of hours of use per day. A lamp to be run for six hours daily may be had at a price much less than double the charge for one to be used for only three hours. The justice of this system has been defended on the ground that "readiness to supply" is as tangible an item of expense as the actual supplying; and there is much soundness in the argument. Every tradesman claims the right to encourage the most profitable lines of business. It has been further extended on paper to embrace a fixed charge to each consumer, irrespective of his consumption, for "readiness to supply." But however correct the theory, we have to deal with the fact that British notions of fairness are strongly in favor of buying by the yard or by the pound. The small consumer may be fleeced to any extent by ordinary tradesmen; but he manages to make himself heard very plainly in his dealings with public companies. There would probably be a strong outcry against any attempt to charge a fixed fee per consumer for "readiness to supply;" and the cost of this item must continue to be regarded as one of the working expenses. It

can only be reduced by increasing the "regular" class of consumers, thus increasing the average consumption per consumer, per service, per meter, per mile of main, and per $5,000 of capital invested.

The Ignition Temperature of Explosive Gaseous Mixtures.

By Mr. A. E. Tutton, in *Nature.*

An important contribution to our knowledge of this subject is communicated to the *Berichte* by Professor Victor Meyer, of Heidelberg, in conjunction with his assistant, Herr A. Munch. The interesting experiments which were carried out some eighteen months ago in the Heidelberg laboratory, concerning the conditions under which the explosion or silent combination of gaseous mixtures occurs, left the question of the precise temperatures of explosive combination undetermined, inasmuch as the necessary high temperatures were attained by the use of boiling salts whose temperatures of ebullition lay a considerable number of degrees apart. The researches have since been continued under conditions in which it has been found possible to determine the actual temperatures with precision. In these experiments, any possibility of the occurrence of appreciable amounts of silent combination has been avoided, in order that the determinations of the temperature of explosive combination might be unaffected by errors due to that cause. The conspicuous novelty of the method adopted consists in placing the small bulb containing the mixture to be exploded inside the larger bulb of the air thermometer employed to determine the temperature; thus at once ensuring that the explosion bulb and the thermometer bulb shall be heated to precisely the same temperature. The objection which at first suggests itself—that the heat suddenly developed at the moment of explosion might exert a disturbing influence upon the indications of the air thermometer—was proved by direct and repeated experiment to be without validity; such disturbance being found to be too small to be measured. The bulb in which the explosion is brought about is not closed; for the explosion of such detonating mixtures of gases at rest—that is to say, confined to a closed space—is so violent that, if the glass escapes pulverization, it is much distorted, owing to the temperature to which it requires to be heated being about its softening point. The distortion usually takes the form of a shrinking from two opposite points, where the glass is drawn in and distended to such an extent as to produce two internal spheres. Such deformation would, of course, alter considerably the volume of the air thermometer. This is avoided by attaching a long stem to the bulb, open at the free extremity, and passing a slow current of the gaseous mixture through the apparatus. The bulb of the thermometer was heated by means of a bath of a fused alloy, consisting of equal parts of tin and lead; and it was found immaterial whether the thermometer was directly immersed in the molten metal or protected by means of a closely fitting refractory metal sheath.

The estimation of the temperature was affected by displacing the air of the thermometer, whose volume was known, by means of a current of hydrochloric acid gas, and measuring its volume over distilled water which had recently been freed from air by boiling.

The first series of experiments were made with the detonating electrolytic mixture of hydrogen and oxygen. The gases were freed from ozone by passage through a solution of potassium iodide. They were then washed through water, with which a Woulfe's bottle was almost filled, after which they traversed a tube packed with numerous discs of brass gauze, which were found effectual in preventing the explosion from traveling back to the Woulfe's bottle. The mixed gases were then allowed to enter the explosion bulb by means of a capillary tube passing down the stem to the bottom of the bulb. The rapidity of the gaseous stream was found to exert no influence upon the temperature of explosion, within the limits imposed by the mode of experimenting. The bath was then gradually raised to the neighborhood of the combining temperature; and the instant the explosion ensued, the air contained in the thermometer was displaced by hydrogen chloride, collected over water in the measuring vessel, and its volume ascertained on the attainment of atmospheric temperature and pressure. By displacing the air the instant the detonation was heard, any appreciable augmentation of the temperature during the moment of explosion was prevented,

As the result of several series of experiments carried out with four distinct sets of apparatus, the temperature of explosion of electrolytic hydrogen and oxygen is found to vary from 612° to 686°. It would thus appear, conformable with the supposition of Professor Van t'Hoff from theoretical considerations, that this mixture is incapable of exhibiting a sharply-fixed temperature of explosion. Moreover, it makes no difference whether the mixture is dry or moist; for, if dried, a small amount of silent combination invariably renders it again moist before explosion occurs.

It has been currently supposed that the presence of sharp solid fragments, such as those of glass, exerts a lowering effect upon the temperature of explosion of hydrogen and oxygen. This supposition has been practically tested and found wanting in accuracy. Neither glass fragments nor sea sand were found to reduce the temperature below the limits above stated. A remarkable result, however, was obtained when pieces of platinum foil and wire were introduced into the explosion bulb. It was found impossible in their presence to bring about an explosion, even when the temperature of the bath was raised to 715°. Quiet combination invariably ensued.

The size of the explosion vessel appears to be immaterial, except when reduced to very small dimensions, such as 4.5 mm. diameter, as in the case of the smallest bulb tested, when the range of molecular forces is approached. In six experiments with this small bulb, no explosion occurred; in others the explosion did not occur in the vessel, but the quiet combustion there initiated was transmitted along the leading tube through the tube containing the gauze discs, eventually occasioning an explosion in the wash bottle, disastrous to the latter.

In the cases of other explosive mixtures, the admixture was effected, in the proper proportion, in a three-litre flask, from which the gases were driven first through a wash bottle and subsequently through a test-tube, arranged likewise as a small safety wash-bottle, to prevent the explosion reaching the larger one. Carbon monoxide and oxygen, in the proportion to form carbon dioxide, were found to suffer, for the most part, silent combination in the apparatus; and the wide limits of the observed temperatures of explosion (636° to 814°) in those cases, when explosion did ensue, were found to be due to more or less of such silent combination.

Gaseous mixtures of hydrocarbons and oxygen were found, however, with the exception, perhaps, of marsh gas and oxygen, to exhibit practically no quiet combination; and these mixtures have afforded most trustworthy and constant temperatures of explosion. Marsh gas was found to explode, as a rule, with oxygen at temperatures varying from 656° to 678°; but occasionally quiet and complete combustion occurred. Other hydrocarbons never failed to yield an explosion.

Ethane detonated with oxygen in three experiments at 622°, 605°, and 622° respectively. A mixture of ethylene and oxygen exploded at 577°, 590°, and 577° in three consecutive experiments. Acetylene prepared by Gatterman's method (which in Professor Meyer's experience, yields it in a purer state than the more recent convenient method discovered by Maquenne) explodes with oxygen with exceptional violence; the wash-bottle being destroyed in every experiment. The temperature of this explosion was very constant; 510°, 515°, and 509° being successively observed. Propane, mixed with five times its volume of oxygen, likewise exhibits a very constant temperature of ignition; 548°, 545°, and 548° being indicated in three determinations. Propylene exploded with 4½ times its volume of oxygen at 497°, 511°, and 499°. Isobutane, mixed with 6½ times its volume of oxygen, detonated at 549°, 550°, and 545°; and isobutylene, at 546°, 548°, and 537°. Finally, coal gas, mixed with thrice its volume of oxygen, was found to explode in three experiments at the remarkably constant temperatures of 649°, 647°, and 647°. It was found impossible, however, to induce a mixture of coal gas and air to explode under these experimental conditions.

It will be clearly seen, from the above experiments with gaseous mixtures of hydrocarbon and oxygen, that the temperature of explosion falls as the content of carbon increases. Thus the mean temperatures for methane, ethane, and propane are 667°, 616, and 547° respectively. Further, the temperature also falls with the degree of saturation; or, in other words, the less saturated the hydrocarbons become, the more readily do they ignite in contact with oxygen. Thus ethane, ethylene, and acetylene explode with oxygen at 616°, 580°, and 511°; propane and propylene, at 547° and 504°; and isobutane and isobutylene, at 548° and 543°. It will also be observed, however, as would be expected, that these variations, due to difference of saturation, diminish as the series are ascended.

Gindele's Gas Meter Connection.

On October 10th United States Letters Patent (No. 506,489) were granted to Mr. Albert H. Gindele, of Jersey City, N. J., for an improved plan of making gas meter connections. Quoting from the specification:

The object of the invention is to provide a simple and inexpensive means for the attachment of the lead pipe, for a meter connection, to

the union nut which is to be screwed upon the hollow post of the gas meter.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar letters of reference indicate corresponding parts in both of the figures.

Figure 1 is a side view of the improvement in connection with a lead pipe portion and a meter post in part; and Fig. 2 is a longitudinal sectional view, on the line 2—2 in Fig. 1.

In the drawings, *A* represents the lead pipe at the end which is to be connected to a meter. There is an exteriorly threaded sleeve *B*, placed on the end of the pipe *A*, and the end of the pipe is then upset to produce an integral radial flange *a* on it. The sleeve *B* is true on the end near the flange *a*, and fits neatly upon the pipe.

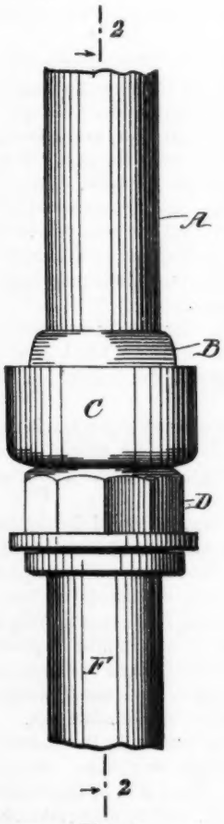

Fig. 1.

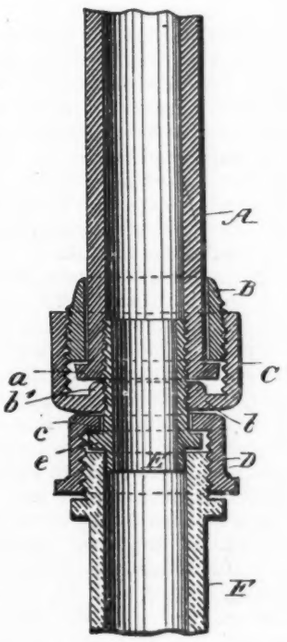

Fig. 2.

A peculiarly formed junction nut *C* is a novel feature of the invention, comprising a cylindrical shell formed of brass or other suitable metal, and provided with an inwardly radial flange *b*, that is threaded on its inner edge which is concentric with the inner surface of the cylinder shell, which surface is threaded to fit upon the threaded sleeve *B*. There is a hub-like projection *b'* formed on the flange *b*, which projects toward the flange *a*, and is true on its face, that is made to bear upon said flange when the nut is adjusted to effect such a contact of parts. The union nut *D* is of the usual form, and is made to loosely encircle the thimble *E*, that is inserted through the central perforation of the inwardly radial flange *c*, which is a part of the union nut. The thimble *E* has an external radial flange *e* formed on it near an end of the thimble that is intended to enter the top of the hollow meter post *F*. The flange *e* has a gas-tight contact with the flange *c* when the parts are assembled to securely attach the lead pipe *A* upon the meter post, the union nut being adapted to have a threaded engagement with the externally threaded end portion of the post as usual. The thimble *E* is exteriorly threaded from a point near the radial flange *e*, to the end farthest from said flange, this part of the thimble being fitted to the threads in the flange *b* of the nut *C*. A sufficient length is given to the thimble *E* to permit its threaded end portion to be screwed into the bore of the lead pipe *A*, so as to produce a mating thread in the soft metal wall of said pipe which will add to the security of the joint and produce a perfectly gas-tight connection for each end of the lead pipe.

It is intended to use the improvement as a substitute for the solder joints usually produced between the thimble of a union nut and the end of the lead pipe, and also between a common nipple that is used to join the lead pipe connection to an iron pipe, which may be either the street service pipe or the riser of the distributing gas pipes for a house.

By using the improvement, a speedy and reliable connection may be produced between the gas meter and gas inlet and gas distributing pipes, dispensing with solder joints in the lead pipe connections.

Mr. Gindele, in calling our attention to the merits of his invention, says: "In shops where all lengths of lead pipe are used, and no special limit stipulated, the fitter can, by making the connection at the house where the meter is to be set, make a workmanlike job, save time in making an extra trip to the shop, to say nothing of saving possibly an hour's time over the old style of forming lead connections by means of soldering. There is also the additional gain that any intelligent workman can make the connection under the new plan. As things go nowadays in the fitting shops of gas works, when hiring men the leading question asked by the employer is, 'Can you make a connection?' and if the reply is in the affirmative the applicant is hired forthwith. Whether he knows anything about pipe or not, the presumption is if the applicant can only make a 'connection' he must be a first-class man, the idea evidently being that only 'crack' men can do this work. With the plan I advance (for practical application of the same see Fig. 3) any handy man or even helper can make a connection, for all that is required is to cut the lead pipe off even, put it through the threaded sleeve (shown at 3, Fig. 3), take a plumber's tenpin and flange it out, then file the lead pipe off level, so it will seat well, screw union nut (shown at 2) tightly together, then take threaded meter union liner (shown at *A*) and screw into union nut, until the liner binds tight into the lead pipe. Where an

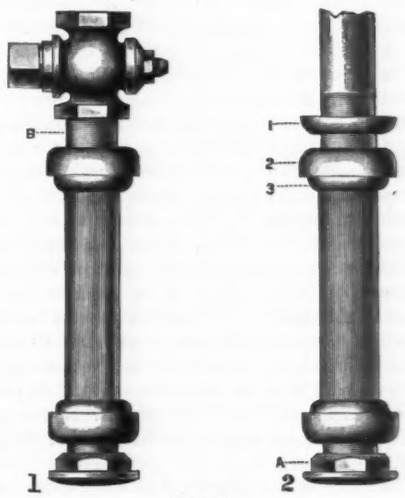

Fig. 3.

hour, or perhaps two, would be used up in making the old style connection, the one described can be completed in five to ten minutes' time. Furthermore, there is a saving of material, as it does away with gas consumption in furnace, solder, acid, rosin and soldering irons, to say nothing of obviating the smell that always accompanies the operation of the plumber's furnace."

[Concluded from page 77.]

Electricity in 1876 and in 1893.

By Elihu Thomson, in *Engineering Magazine.*

In 1876 the storage battery was practically unknown. A crude form devised by Plante had been experimented with for a considerable time before, in the laboratory. The eminently successful use made of the electric launches on the lagoons at the World's Fair was an ample demonstration that in the past few years a new field for electrical work had been opened up. The application of the battery to boats is of course but one of the uses for the modern storage cell. Many electric stations in Europe and a few in the United States have within late years added an equipment of batteries to work in conjunction with their dynamos in giving out current energy when the consumption is heavy, and to absorb energy or become charged from such machines when the consumption is small. This in a large measure prevents overloading at one time or the running of the machinery with loads too light to be economical at other times. How far experience will confirm the apparent advantage of such a plan remains to be seen.

The largest single exhibit of an electrical nature, was without doubt the Intramural railway and its power house—together a grand practical exemplification of electricity applied to traction. It was remarkable in many ways as a piece of engineering and operated with the greatest success. It emphasized the fact that the days of steam locomotives on elevated roads in cities are numbered, and that just as surely as the horse car has given place to the trolley car, so must the electric motor supplant steam propulsion on the roads in question. Yet in 1876 there was no hint or suggestion of such extended use of electricity on railways—and, in fact, no such applications had been made. On the Intramural road a conductor rail with the ordinary rails for return circuit was used, the current being taken up by sliding shoes bearing on the conductor rail. The motor car at the head of each train, besides the ordinary seats, was provided with four electric motors, one geared to each axle individually, while the controlling mechanism was arranged so as to connect the motors in single series for starting and to make successive changes passing through intermediate connections until the one having all the motors in parallel was reached, the condition for maximum speed.

This arrangement, with refinements of detail especially designed for this work, and first put into full operation at the World's Fair, gave great economy as well as flexibility in the handling of the trains. One of the best illustrations of the progress in the art of electrical engineering in the past few years was the building in the station of the Intramural road of the great direct coupled continuous current dynamo of 2,000-horse power capacity. This machine—by far the largest continuous current dynamo ever made—was lately described by its designer, Mr. Horace F. Parshall, in *Engineering Magazine* (September, 1893). It is a comparatively simple undertaking to design and construct very large alternating current generators, since in many respects they are like duplications or enlargements, simply, of the elements of smaller similar machines. This is not so with continuous current types, as the problems of armature reaction, air gap, and self-induction as affecting the working of the commutator at various loads, have to be carefully estimated, while the relation of turns on the armature to number of segments in the commutator, the proper proportions and construction of the commutator itself, and the other proportions, have to be studied with great care and adjusted within limits. All this makes the production of so large a machine, built as it was without previous experiment, and its parts put together, even to the assembling of the sheet iron pieces of the armature, in the station itself, a veritable triumph of engineering skill.

Speaking generally, it is not far from the truth to say that at the World's Fair there was as much to be seen of electrical application outside of the Electricity Building as within its walls, though this building was itself a temple of electricity. There were, it is true, a number of exhibits of no special significance, such as those of shifting light in masses of incandescent lamps, obtained by complicated switching appliances, colored lamps being freely used. The most artistic display of the kind was the Edison tower of lights, a creditable piece of work, the effects obtained from which were certainly very striking and beautiful. The large and varied display of modern electrical apparatus and machinery, together with the various historical exhibits were of deep interest to the student or engineer. There were found a fully equipped modern telephone exchange and also Dr. Gray's "telautograph" which is in a certain sense an intended rival of the telephone. There also were found many types of dynamos of various makers both here and abroad. Electric motors were found applied to all manner of work—pumps, hoists, elevators, locomotives, and mining machinery generally. Electric arc lamps and machines, carbons, of all leading makers, were here together with exhibits showing many forms and patterns of incandescent lamp, lamps of low voltage to lamps of high voltage, lamps with one filament to lamps with a dozen filaments, lamps of one candle power to lamps of hundreds of candle power, etc. There were full lighthouse equipments with their huge compound lenses on view. On the one hand was to be found appliances for generating electricity of enormously high pressures, such as would leap in torrents of sparks over more than five feet of clear air space, and on the other hand apparatus for electric welding and metal working capable of yielding currents of 50,000 amperes with pressures as low as two or three volts. The comprehensive exhibit of practical work done in electric welding, including the largest weld ever made by electricity, in which the section at the weld was forty-eight inches of steel, was of great interest to many practical men.

A number of creditable exhibits of alternating current motors of such types as single phase, diphase, and triphase construction were found, so that the respective characteristics of this most interesting of the recently developed forms of alternating current apparatus could be examined. This class of electric machinery is of so recent production that we must look to the future for its wide application. Everywhere in Electricity Building was evidence of enormous growth of electrical industries. It could be partly understood from the variety of such things as switches, safety cutoffs, wires, cables, insulating materials, found there, aside from the heavy machinery.

In the department of measuring instruments alone, the progress to be noted was remarkable. Ammeters, voltmeters, wattmeters, recording wattmeters, standard resistances, standard cells, electrical balances and bridges, of the highest degree of excellence, were not wanting. With the refined means of measurement so provided the estimation of electrical forces and quantities may be made with a rapidity and precision hardly equalled in any other department of physical science. Enough has been said, however, to indicate what a harvest has, in the past few years, been the outcome of the earnest effort of brain and hand in the electrical field.

The one discordant note in all this great display of genuine scientific and engineering work was found in the fact that in this same temple of science—in Electricity Building itself—naked imposture, quackery in the form of so-called electric belts, hair brushes, insoles, and what not, had obtained a footing and stalked forth unabashed. No words of condemnation can be too strong to be applied to the parasites, who in the guise of healing and benefaction, succeed in extracting perhaps the last money from the sick and suffering for their worthless trumpery. The fact that such exhibits were found in 1893 holding place alongside of genuine electro therapeutic appliances of undoubted merit only heightened by contrast the great shame of their presence.

Within the limits of the present article it has manifestly not been possible to do more than briefly refer to such electrical features of the World's Fair as show in concrete form the great advances which have taken place since the Centennial year.

Our technical schools and universities now devote to the teaching of electricity as a branch of engineering special courses, special laboratories, special instructors. Formerly a little electrical knowledge taught was taken up as a department of physics.

In this present year, the arc lamps in use are numbered by the hundred thousand, incandescent lamps by the million, while millions of passengers are carried daily on electric cars, thousands of horse power transmitted and distributed by electric motors, thousands of tons of metal refined annually by electrolysis, chemical decomposition on the larged scale effected, as in the production of cheap aluminum, electric furnaces are turning out their special products, such as carborundum of diamond like hardness, and electric welding and metal working machines are in active service in a large number of manufactures.

In summing up this great growth we must not forget the enormous extension of telephone service systems in the past few years. So great have been the advances that it is natural to expect that in the immediate future similar rapid and important work will be undertaken and accomplished. It is difficult to play the role of a prophet unless the prophecies be made so numerous that some of them cannot fail of realization. There are, however, some things concerning future electrical development about which we can be positive. It is not likely that, except in details, much advance will be made in dynamos and motors. The efficiency of well designed types is now so high as to leave very small opportunity for improvement. Large dynamos at full load have commercial efficiencies ranging from 95 to 97 per cent. Transforming apparatus of various types may readily have at full load a net efficiency of 97 per cent. The possible efficiency of arc lamps is about reached—and with the incandescent lamp the volatility of carbon at high temperatures governs the efficiency and life. The higher the temperature the more efficient the lamp, the more volatile the carbon of the filament. and the less will be the life of the lamp. It is unlikely that any better material than carbon will be found for the filament, and the properties of carbon as to volatility can probably not be changed.

The cost of these lamps is now about as low as is consistent with good quality and uniformity. The use of transformers for raising or lowering the line potential, permits long distance transmission of electric energy with moderate loss. The conditions of the most efficient use and operation of electric motors as a source of power when transmitted, have been well worked out, so as to leave but little further to be accomplished in that line.

We can hardly expect, therefore, to make any radical gain in the operation of electric plant unless by the utilization of new principles in unexplored fields. A substantial gain in the economy of the development of power from fuel is of much greater moment than any possible gain in the efficiency of the electric plant. Hence electricians are looking for cheaper power, as that and that alone now means cheap electric-

ity. For the same reason attention is more than ever concentrated on the utilization of water power, as of Niagara itself by the Cataract Construction Company. Much future work will be done in this field, and it will give rise to many new problems for solution by the electrical engineer. The laboratory work of to-day becomes engineering work of to-morrow. Work which to-day is in the experimental stage reaches its full commercial completeness only after considerable practice with it under varying conditions. The advance work goes steadily on, but in channels which demand more and more intricate knowledge of electric actions. It is the fervent hope of many an electrician that, at no very distant time, the energy of fuel may be converted more directly into electric energy, and without the enormous percentage of loss that is involved in present methods, and that some means may be found to further transmute the electric energy into light with but a small percentage of dark heat, instead of present wasteful methods; but this is still a hope only, and there is not even a probable solution indicated.

In the department of electrical engineering work, the early future will I think witness, in addition to a constantly increasing use of electricity for illumination, further application to chemical and metallurgical work. The field for the application of electricity to mining, for hoists, for pumping, drilling, mine haulage, and the like is very wide. While it is not probable that the steam locomotive for long distance railroading will soon be supplanted by electric locomotives, still there is a growing interest in these latter as applicable to special cases, such as specially designed high speed roads between populous centers, for tunnel work and elevated roads in cities. As feeders for trunk lines of railroad it would seem that trolley lines are admirably adapted both for passenger and freight service, and their employment in this way will doubtless become of great importance in densely peopled localities.

There is also a field for the application of electricity stored in batteries to propulsion of road vehicles, a field in which but little has hitherto been done. Electricity generated under present conditions, involving in the first conversion into mechanical power such an enormous loss of heat energy of the fuel, will evidently not be applied as a general heating agent. In certain cases, in which the disadvantage of high cost may be outweighed by superior advantages of application, as in cooking by electric heat, there may result a considerable extension of its usefulness. But that it can be economically applied simply to heat metal bars for forging in a drop press or rolling machine, is not at all to be expected. In special cases of distinctly local heating of metal for welding, bending, or other process, it is now not only used with success and economy, but it would appear that many additional applications of this kind will be made in the future.

While it may be reasonable to look forward to the ability to telephone through an ocean cable under the Atlantic, it is hardly likely that we shall travel over it in ships propelled by electricity. It would indeed be possible to construct electric motors able to turn screws and propel our largest ships, but the supply of current energy to them at the rate of ten to twenty thousand horse power, for five days continuously, would require a storage battery to be carried such as would be enormously costly and so heavy that it could not be placed aboard without sinking the ship. It should, however, be borne constantly in mind, in dealing with the subject of electrical applications, that a new discovery might at any time change the aspect of every prophecy based on present knowledge and conditions.

The Business End of Electricity.

[A paper read by Mr. H. C. Thom before the Northwestern Electrical Association.]

From the station chimney rises the dense smoke in stately dignity which vanishes beyond the clouds like the millions that have been invested in the "coming thing." It attracts the attention of the professional man, and he delivers himself of an epic about the humming wheels of industry, the illimitable resources of this great country, and the transcendent ability of inventive genius. A tiny thread of light comes to the rescue of the lawyer's aching eye, and he lays back and watches it in a meditative mood. It grows brighter and brighter, sending its soft rays into the farthest corner, driving skeletons into deep closets and annihilating phantom memories that have crept nearer and nearer as night drew on. At last the office assumes a noonday hue, and day thoughts take the place of evening dreams, and the lawyer soliloquizes: "By George, that seems easy. I wonder where last month's bill is. Eight dollars! Confonnd the corporation! A fellow is held up in broad daylight and commanded to deliver by a soulless syndicate. I wonder if that crowd has an exclusive franchise. When I get a little more time, I will see if it cannot be busted." Then ponderous lawbooks are taken from their dusty resting places, depositions and briefs are drawn from their pigeon holes, and the lawyer works on far into the night, joining, matching, fitting, summarizing an invulnerable argument against a widow whose engineer husband wooed death by standing at his post. The tiny stream of light gleams brightly on the work until the bill for services is written and copied.

The enterprising merchant hangs a half dozen arc lamps in his beautiful emporium, and places the many-hued incandescents in every nook and corner. Prisms and mirrors are artfully suspended, and then this wonderful panorama bursts in all its glory upon his amazed patrons. An advertisement appears in the morning paper to the end that goods can be examined at Mr. Doe's by electricity, and every buyer is assured that color and quality show better and truer to reality than in the full glamor of the noonday sun. The only fellow who feels uncomfortable about the whole transaction is the station collector, who, at the seventh call, is told that the light is a snide; that the bill is exorbitant; that the corporation cannot expect to get rich out of the customers in one month; that he will see what can be done about getting in a competitive company. And so the battle goes on. Sir Edward Coke originated the saying that "corporations have no souls," and it has been taken up in its glad refrain by the millions *out* of corporations, like the measles in crowded tenements.

It is neither the scope nor the purpose of this paper to discuss the technical details of the business. These must be met by the struggling managers and bewildered collectors in their own way, because local conditions vary so radically that the prescription of a physic in Superior might act as an emetic in Sheboygan. With your permission, such matters will be touched as are generic to all plants. You may not agree with the opinions submitted. In truth, I trust you will not. The greatest good always comes from an informal discussion. If I am unable to defend my positions, I will try your plan next month.

In the organization of a corporation, be sure it is legally formed. Don't go at it by guess. Let someone who has experience do it for you. This kind of service comes cheaper than litigation. Corporations are not created for the day, and are never established on a silver basis. Fix upon the capital stock. Have it large enough and pay it all in. Do business. Discount every bill. Buy close and you can save your salaries out of your methods. Do not bond or borrow if you can see a way out. Bills payable are an abomination in the sight of a stockholder. In building a plant, keep one eye on your bank balance and the other on the future. If you render good service, extensions will come as sure as short circuits. Don't carry a dead weight in machinery, but when the time comes have boiler, engine and dynamo room. Mr. B. who owns the next lot is lying awake nights to squeeze the "soulless corporation." Who ever heard of a man being hung for asking four prices for the next 100 feet. History answers, not a man. But the record is teeming with wrecked syndicates that stalk the earth, white and ghostly, because they are bloodless, brought to an untimely end in an endeavor to believe the popular theory that electric light grows on trees.

When the organization is perfected, the stock paid in, the ground purchased, and specifications accepted, we are then ready to install machinery and buy supplies. Please take me by the hand and we will walk down to the county court house in order that we may make court record of formal proceedings for divorce from any particular electrical supply company. To be sure you have been married to one of them for a long time, but you cannot do business with more than one wife outside the limits of Utah. You must give up the young man who knows all about everything, but is dead sure of two things—your business and the fact that he handles the supplies that are worth putting on a foundation or hanging on line. Good bye, my darling, we love you but we are getting venturesome now. The field is large, you know, and we are about to walk time. Let us be careful, however, until our legs are steady, let us talk the matter over with the other fellow, softly jingle the fifty-two cent spot dollar, demand a guaranty that will stick, and when we are satisfied that we are getting the best, cheapest trade. Every metropolis has a supply house. Most of them are backed by representative men, and as competition grows prices cheapen, and standard goods only must be turned out to hold the ear of men who walk alone. It is false economy to buy anything but the best. It may do for the time, but the time will soon come when you endeavor to forget your natal day.

The next question is one of labor, skilled and otherwise. Boys should be in school. A good way to arrange the old precept is that good hire is worthy of good labor. Engage a man at such wages that you can replace him in twenty-four hours at the same pay. If you cannot get

a man in his place for the same money, you are not paying enough. If you can get as good service for less, you are paying too much. If you stand on this rock, no union will dictate, no strike will annoy, and the loud-mouthed agitator will meet a cool reception in your town.

When outside operations are begun, we have occasion to look more closely at the franchise. If your station is the only one and you erect the first pole in town, little trouble ensues. Every man is your friend. You can stick a pole in front of everybody's big window, or connect with the favorite shade tree of every retired farmer on Quality street. Everyone gives a nod and an encouraging smile. One man says: "Private enterprise; good. I like to help such things along; looks metropolitan; no city tax; see? Why don't you fasten that guy wire to the corner of my barn? There, that's all right—cheaper than to set a pole. Needn't thank me, sir. I am only too glad to help the thing along." Your heart swells with love for the human race. How can men be so narrow as to say that the average man is selfish? Down with such carping. All one has to do is to treat everybody alike; to be decent and one can make friends everywhere.

Wait my dear boy. Wait until you get $40,000 into the station. Wait until you set a thousand poles at $7.00 each and string wires until God's blue sky looks like a weaver's loom. Wait until the city shines like the realm of glory. Wait until you invest notes and bonds that have taken years of patient economy to accumulate. Wait until you get $100,000 in giddy smokestacks and puffing engines, bolted to solid rock. Wait until you have taken the shapely cedar from northern Michigan and stuck it in six feet of mud at your own door. Wait until the *Daily Chronicle* comes out in big headlines and says the station is a marvel of human ingenuity and systematic arrangement that the service is perfect and compares it to that of St. Louis, and further states that the city is very fortunate to have men that are public spirited enough to invest their money in such a semi-public enterprise; that we have a model manager whose sole aim is to serve the city and patrons upon the line. Then you soul is filled with glory, and you know now that if you are stricken, the verdict of all men will be, "Well done, thou good and faithful servant." Wait a little longer. Wait until some patron discovers that in a city by a big river they get an arc light until twelve o'clock for $5.00 a month and your bliss is a dream. Within a day this same patron discovers that "the meter is a fraud; manufactured under contract to register twice the current used." A council man has been seen by an ambitious supply house, and the dance begins. The panic spreads; the *Chronicle* catches it, and to your untold horror, you discover that the city editor knows more about the expense of running your plant than the whole station force together, though how they can keep such a man on the staff at $6.00 a week forever remains a mystery.

A franchise for a light plant is not a very valuable document. In my judgment, an exclusive franchise is unconstitutional, and if it is, the field is open to all comers, and this being the situation, you are simply accorded the privilege of doing business in the town and swelling the assessment roll. A shoemaker or a plough factory can do the same, often assisted by a good bonus. When the importance of electric illumination is once understood by municipalities, no doubt instances will be numerous when large appropriations will be made by common councils to help struggling corporations pay five per cent. dividends. Indeed, a franchise is often but a medium through which the city can use valuable property of the company without rental, or it may contain authority vested in the council to grant the use of valuable company property to competitive corporations at a nominal rental. A railway franchise may have greater commercial value from the necessity of the situation. Two lines upon the business streets would not be tolerated by the citizens.

For $10 the Secretary of State says, "you are a corporation." Certain laws control, and limitations and liabilities are established. Every officer and stockholder knows his duty and responsibility under the statute. As a rule, your patron thinks that the great seal of the State dignifies scullduggery and that the Goddess of Justice upholds oppression of the working millions. In the same way the word franchise is surrounded by a halo of mystery. It is judged a symbol, placed in the hands of a few capitalists who hold it aloft while the taxpayer does penance by groaning aloud and going home sober at night, else his neighbors might note his unsteady gait. This popular fallacy about corporations and franchises exists. It can be met and changed in but one way. Of that I will speak later on.

The question of wiring is a difficult one. Shall the company do arc wiring gratis? Shall the company do incandescent wiring gratis? Shall the Company do all wiring gratis? Shall the company wire at all? It is easy to understand conditions that would compel a company to answer in the affirmative all of the above questions. If I were starting a new plant, I would not wire at all. If the customer pays for wiring, he then has an interest in the plant. He is less likely to be fickle in his patronage. If it is done by experts engaged by the customer, a heavy burden is taken from the company. On the other hand—the system of free wiring may have been inaugurated before the purchase of the plant. Then it is indeed difficult to change. Lamps for residences and lamp renewals for residences and commercial circuits raise the same line of questions. Conditions will force you to meet these issues as best you may. Whoever wires, have it done in such a way that it will stand rigid inspection.

I have labored to bring about a system whereby an inspector, appointed and maintained by an insurance board of underwriters, should make semi-annual inspection. Let him examine, accept, or condemn and report. No one has howled about wires longer or louder than insuranceites. Let them pay the fiddler and dance till morning. One thing is clear—that if a company furnishes free lamps and renewals to residences, the same schedule of rates cannot obtain as upon commercial circuits. If it pleases the gentlemen present to bring this matter up in discussion, the light of experience may help those who are in darkness, although engaged in selling light by the rod.

No business requiring capital and brains ever succeeded without application to details. Corporative concerns are much to blame, and in a large measure responsible for the attitude toward them by the people and municipalities. We owe it to the taxpayers and to the city as well as to ourselves to so administer our affairs that good service can be rendered at reasonable rates. The public knows more about electricity that ain't so than of any other commodity. We cannot and ought not to expect the public to always know the truth. After nearly 1,900 years it is still a mooted question who married Cain, and many are skeptical enough to think the story of Jonah and the whale somewhat fishy. It is only a little while since the wizard hung his lamp in Menlo Park and made the astounding statement that it would not go out before morning. We should not hold people to quick conversion. The electric field is so vast and so fertile that the whole scientific world has devoted all its powers to general knowledge, without stopping to intensify processes. The result has been lack of economy in production and continual changes in machinery and apparatus, thus entailing heavy losses which corporations have added to expense account, therefore making room for charges of extortion by the customer.

My friends, the only way to set at rest forever complaint, criticism and rebellion against rates is to set our house in order, sweep up every item of unnecessary expenditure, bridle the current and drive it in its proper channel until its mission is fulfilled. Establish a fair business per centum for your investment, and then go straight ahead. Do not let Mr. B——, the doctor, or Mr. C——, the lawyer, conduct your affairs or vary your schedule. Treat them as fairly as you do the council; no better, no worse. If necessary, go before this body with your books; let them see that you are only getting a fair return for money invested, and a just per centum for depreciation in plant. Every tradesman, every factory and every corporation is justly entitled to this at the hands of all honest men who consume the product. If these methods are persued and your customer kicks and the city still finds fault, they never will be satisfied until generators can be run by the grace of God and the countershaft be belted to the bolt of Job. Then we can say, let there be motion, and there is motion without cost. When this millennium comes trolleys will hang over the mighty Mississippi and picturesque Hudson; the traveler can lounge from the window of the lightning railway car while telegraph poles shrink to finetooth combs as we rush through the air, and the milestones which dot the rolling prairies shall group themselves so that they resemble the populous cemeteries of the sunny south.

Indifference to Boiler Firing and Management.

Mr. Daniel Ashworthy, of the American Society of Mining Engineers, makes the following appeal for the correction of the abuses named in the heading:

Observations extending over a period of a quarter of a century in a practical and professional way have presented opportunities to note, in the greater number of manufacturing establishments, a continuous decline in the grade of service of those in the position of firemen and boiler-room managers, this corps of operators seeming, at least, to have remained in *statu quo*.

Combining the development of the boiler and the engine, the amount of research and practical application that have been and are being applied, for efficiency and economy, are such as to be incalculable. A retrospect viewed in the light of present results shows that these efforts

have been of an exceedingly fruitful character. The development has carried with it the imperative advancement of those in charge of engine management to such an extent as to create almost anew this body of men.

Such an intellectual advancement in the department of mechanics, we believe, is without precedent, and, in every sense, challenges admiration from every quarter. Notwithstanding these favorable features, we are constrained to say that we are radically defective at the very threshold of this field, by reason of relegating the firing of boilers to the most ignorant of operatives; or to put it in a plain way, there seems to be an almost unanimous idea that anyone who can shovel and throw fuel is good enough for a fireman. Close observation and contact, for a period of years, with numerous plants of varied character, increase the conviction upon this point. Recognizing, as we all do, that the furnace of the boiler is the prime feature and great initial point from which is the source of power, does it not properly follow that if economy and efficiency are deserving of efforts in the advanced stages, this is the very point that should be treated with every consideration of intelligence? Should not the fuel, furnace, and boiler receive the thoughtful attention that the engine receives from the careful engineer?

In looking upon this subject from a mechanical and engineering standpoint, we are fully alive to all the requirements to give complete combustion and thorough distribution of heat units, proportion of grate area and openings, proper amount of air, conduction of heated gases, are all carefully considered. When all is completed, we have had the wonderful spectacle of these conditions being turned over to the simple treatment of ram-jam shoveling and slice-bar operations. I claim that the fireman should know, at least, the elements of combustion, the importance of proper management of fires to produce the greater results with the least expenditure of fuel.

Now, it may be said that this is being greatly overcome by the application of mechanical stokers, a point that is frequently (and, I believe, without thinking) claimed by those interested in placing stokers. This is a great mistake, well known by those conducting tests, the results always being superior with the greater intelligence or the operator of the machine. This deplorable and absurd state of affairs is doubly aggravated by, not simply indifference, but actual encouragement, based upon the idea that any one can shovel and throw in.

Within the past few years, in every community where cleanliness, taste and health are considered, there has come forth a crying appeal to the authorities to lessen the great evil of smoke in the atmosphere. In response to this, inventive genius has promptly come forward. The multitude of devices that have been perfected and put in operation furnishes ample testimony of this fact. Many of these, when properly operated, accomplish satisfactory results in smoke abatement, but no inventor has ever had the temerity to label his machine or furnace, "No skilled fireman required." Per contra, it is well known that the most intelligent fireman produces the best results, and it is also an undeniable fact that the best devices are set at naught by incompetent operating. The writer has been brought in contact with large fields of boiler practice, and in many cases, aside from other disqualifications, the firemen were unable to speak or understand a word of the English language. It may be said, as I have heard it said, that these men are not paid to think, but to do. Well, they do do. They will do up a coal pile, furnace and boilers with alarming rapidity. I say alarming to those whose views are broad enough to consider the initial and important points. On the other hand, it is a lamentable fact that there are a great number of men in official positions as superintendents and proprietors of establishments, who seem to be utterly incapable or unwilling to note the importance for the necessity for a higher grade of labor in the firing and management of boilers.

What is greatly needed at present is to lay aside the idea that anyone is good enough to fire and manage boilers. There are many plants in operation where, by incompetency in this line, the steam efficiency is greatly lessened, furnaces and boilers working in neglected conditions, fuel wasted, and the community begrimed with volumes of unnecessary smoke; and, in addition to these evils, that of jeopardizing lives and property. Unless this matter is considered, and such action taken as will improve this corps of operatives, it would seem absurd to be continually reaching and extending into the higher refinements of steam engineering, when such simple and important features are ignored at the threshold.

As a fitting close to this, it would be proper to ask what degree of intelligence or knowledge would qualify one to fire boilers.

1. That the fires should be maintained with uniformity, and that no openings, in the form of bare places, showed upon the bars to permit the cold air to pass through.

2. The judgment that will enable him by a glance at the ashpit to know at once, to a great extent, the condition of the fires.

3. He should know something of the various fittings of the boilers, such as valves, etc., and the details of the furnaces.

4. But not least, an ambition to grasp the details, so as to qualify him for a still higher plane, which would certainly follow, provided there was judgment enough in the superior to note such details.

Inclined Retorts Successful at Brentwood, England.

The London *Journal* says it is some time since we had occasion to chronicle anything of special interest in connection with the installation or working of inclined retorts. Many experiments have been tried in different parts of the country with carbonizing plant constructed upon this system; and almost as many variations have been attempted on the original theme. Indeed, the earlier history of the introduction and popularization of gaseous and regenerative firing has been repeated in this regard, and for the same reason, which grows out of the personality of the existing race of British gas engineers. The ranks of the profession contain many energetic individuals who do not like to be behindhand in trying and utilizing any new thing in the methods and appliances of gas manufacture; but neither do they like following tamely in the footsteps of any other engineer. Consequently, when any novelty in gas technics is "in the air," it is taken in hand by several would be pioneers, who no sooner grasp, or believe themselves to have mastered, the essential idea, than they proceed to give it a shape of their own. There is much to be said in favor of this independence of spirit on the part of technicians; but it also has its disadvantages. If it is granted that the improver upon a suggestion that comes to him from without frequently deserves the description in other than the Patent Office sense, it must also be admitted that not every variation on a theme is necessarily an improvement; and the trick of straining after novelty often means much superfluous experimenting and unnecessary waste of time, pains and money. Works managers are apt to overlook the consideration that boldness of initiative may as well be shown in frankly owning that a thing is good as it stands, as in trying to give the same thing a fresh, or proprietary, twist. Nothing that has recently appealed to gas manages has suffered more manipulation—it might almost be said maltreatment—of this kind than the sloping retort. It is not necessary to believe that this system of carbonizing, as revived by M. Coze, of Rheims, was perfect, to hold that it has not been vastly improved by the numerous modifications that have been applied to it upon its introduction into various English gas works. As a matter of fact, M. Coze's particular contribution to the solution of the problem of working gas retorts by gravitation was open to criticism in several respects; but it is equally true that some of his followers in this field of ingenuity have failed to touch the gravest of the difficulties of the problem.

It was with an awakening of interest in a subject that seemed to have become more threadbare than really exhausted, that we recently received an invitation from Mr. Frank Morris, the Engineer of the Brentford Gas Company, to inspect a bench of inclined retorts actually working at the Brentford station of this Company, which we were given to understand embody the last expression lent to the system by the first English gas manager to look into the question revived by M. Coze. It was at the Southall works of the same Company that the Coze plan was tried; and it was on the faith of the results of experiments at Southall that the Automatic Coal Gas Retort Company was started. It would appear, however, that this venture did not carry with it all Mr. Morris's interest in the system, for he has never ceased his own labors in the cause, and has now arrived, as he claims, in conjunction with Mr. Husband, at a pattern of setting which leaves nothing to be desired on the score of cheapness, simplicity, and efficiency. What is on view at Brentford may be succinctly recounted as follows: In an old stage retort house, standing end-on to the river wharf, where the coal barges come for discharging, there once stood a bench of eight settings of horizontal through retorts. This structure has now been replaced by a bench of inclined retorts, 20 feet long, comprising eight settings of sixes, which, owing to the extra length incidental to the slope, stand on a 17 feet base. These retorts are 21 inches by 13 inches, Ω-shaped, with circular self sealing lids. They are open at both ends, similar to horizontals, and are therefore not Coze retorts, which have a charging end made as a cast iron bend buried in the brickwork. The single ascension pipe is at the lower end. Instead of occupying the center of the house the bench is placed nearer to one wall, from which it stands sufficiently clear to allow room for the charging hoppers and the charging stage. This leaves plenty of space, air and light on the other side.

Those who have taken notice of the settings of inclined retorts to be

seen in more or less successful use up and down the country, are aware that these usually invite criticism in the threefold respects of heating, drawing and charging. We have no hesitation in stating that the Brentford settings struck us as being by far the best yet shown in all these points. The heating of the retorts was full, uniform, and neither more nor less than the requirements of the coal in use demanded. The firing is regenerative, according to a simple plan devised by Mr. Morris. The performance of the furnaces seems to be all that can be desired. The heats could be so pushed, if required, that the top retorts would work off a charge in four or even three hours; but for many reasons it is preferred to so gauge the temperature that the bottom retorts shall be worked off comfortably in the space of six hours, which is secured without difficulty, while the work of the fuel is so localized that the temperature of the main flue is down to about 700° F. We saw a charge that had come to drawing at the usual hour, drawn in the best possible condition. The coke was sound, of fair size, and thoroughly worked off. So good is it, as a rule, that, as we were informed, buyers ask and wait for it, if it is to be had. The 8 hour shift is in vogue at these works, and although, on the occasion of our visit, we could not wait to see a 6 hour charge in and out, we saw several retorts of the next draw taken half an hour before their time, and from this state, and the general appearance of the retorts when empty, there could be no difficulty in accepting Mr. Morris's statement that the settings deal with their 6 hour charges of heavy Durham coal with the greatest ease.

Being perfectly but not overburnt, the coke in all cases came out with little encouragement. Good firing is half the drawing; and the absence of both flare and dust in this instance was noteworthy. (It should be remarked that some of the first settings built in this bench were inclined at an angle of 30°. This was afterwards found insufficient; so with the latter settings an angle of 31° was adopted. The difference is marked in the drawing; for whereas the older retorts require the encouragement of a long, but light, poker to induce them to discharge their contents, the newer ones do so very readily upon being "tickled" from beneath with a short rake.) In no case was it necessary for anybody to go on the top to push the coke down—indeed, there was no convenience for, or even possibility of doing anything of the kind. When the lower lid was slacked off, a man held a scoop under the mouthpiece, to catch the drip of pitch, which amounts per mouthpiece to about as much would lightly cover a shovel. At any rate, one scoop takes the whole of the drippings from one draw, which is duly deposited in a tub outside, where it presently sets hard. The mouth of the ascension pipe is then augered; and, in the case of the top retorts, the shoot is put in place for filling the furnace with the hot coke. A glance up through any retort before the charge is touched shows the retort filled to within a very few inches of the crown with a most evenly-spread load of coke, that only waits the slightest touch to pour out in a red-hot avalanche.

If good drawing means good firing, so also does it mean proper charging; and this last is one of the secrets of the Brentford success with "slopers." As already remarked, the retort house is end on to the coal wharf. Here stands, on an elevated platform, a steam crane and "grab," which lifts the coal out of the barges alongside, and drops it upon a grating over the elevator pit. This grating retains the big lumps; until they are smashed by the attendant lad; but the bulk of the coal goes down at once to the pit, whence it is elevated and conveyed into a continuous hopper which commands the charging ends of the retorts. Sufficient coal for a charge—generally 6 to 7 cwt.—is let down from this hopper, by means of a modification of the "shot-pouch" device. As the top mouthpieces are at three different levels, three shoots, of corresponding length, receive the charges; being run along on a rail to the positions required. The shoots terminate in a hinged shoe, which enters the retort mouthpiece, and directs the charge to its destination. In connection with this shoe, however, Mr. Husband has worked out a very simple and ingenious system of "checks." These are merely mechanical obstructions of different shapes and sizes; and though insignificant enough in appearance, in reality they are indispensable for effecting the even distribution of the charge over the sole of the retort.

The man who does the charging, and stands for the purpose upon a wooden stage quite clear of all heat, smoke or flame—not upon the setting at all—knows what size of "check" to use for the different sizes or condition of the coal he has to deal with. This checking is fixed, say, for the normal sort of coal, and is slightly altered as the coal is found to run larger or smaller. Mr. Husband states that, by manipulating his "checks," he could either send all the charge down through the retort and out on the stage, or heap it all up in the top mouthpiece and the shoot. As we saw them used, however, the charge was most evenly bestowed throughout the retort. Gas managers will hardly need assuring that, if Mr. Husband's system of charging will grapple with all the different varieties of coal that gas works have had to put up with during the last few months, it is good enough for anything.

The above description is practically all that there is to say about the Brentford working. It has sometimes been objected to inclined retort systems that the men working them are more exposed to heat and fumes, and have as hard work to do, as with horizontal settings. This is certainly not the case at Brentford, where the men working the "slopers" are only actually on the stage from 2 to 2½ hours out of their shift, as compared with 4 to 4½ hours active service per shift in the horizontal houses. This statement, of course, gives the former the credit for the elevators. On the other hand, the Brentford "slopers" are not so large as they might be; and if they were 25 inches wide the saving of labor with them would be 54 per cent., according to Mr. Morris's calculation. Moreover, settings of inclined retorts have usually been costly; but Mr. Morris claims to have brought the cost of a complete plant, including elevators and power, but excluding the house, down to $10.73 per square foot of retort floor, or carbonizing surface, which is only a small fraction over the expense of horizontal settings. The wear and tear of the settings must be small, seeing that the retorts are not knocked about by heavy tools, machine or hand; and the heat is not a cutting one—the draught being very slight indeed. With regard to the cost of working, we are informed that an extensive installation on Mr. Morris's plan is now being erected for The Gas Light and Coke Company at Bow Common, the contract being in the hands of Messrs. Gibbons, of Dudley, who guarantee the successful working of the same at a cost not exceeding 37 cents per ton of coals carbonized, "all in." At Brentford the working gang takes $7.97 per day, and serves 148 mouthpieces, which, at 3 cwt. average, amounts to 22 tons 4 cwt. This works out to a charge for carbonizing wages (including elevating) of 75 cents per ton. There has been no undue hurry in making public these results, for the house was started in work under the system so long ago as Sept. 21, 1891.

Asphalt in Roadmaking.

"J. S.," in a recent number of *Paving*, says that the general utility of asphalt for roadmaking has long been recognized, and that in all well-constructed cities it is indispensable. Its commercial uses are many, but its adaptability for building purposes and its worth as a roadmaker make it especially valuable. Of a viscous nature, it readily coheres with any hard substance that may be introduced. This coherent quality enhances its value to outlying townships, particularly as to roadmaking, for it can be mixed with any substances locally plentiful, such as sand, gravel, broken stone, etc., to a harder or more desirable consistency.

It is significant that in America, with the general commercial extension, there has been much neglect of the roads. Leading to and even in large manufacturing and commercial centers there are to be found roads which in dry weather baffle the strongest team. In wet weather they are impassable even to unloaded trucks. In farming districts they are deplorable. To have roads in such a state is undoubtedly the falsest economy. In European countries much advance has been made in the last century toward improvement of those vehicles of the industrial communities with much saving. The farmer there has awakened to the fact that the cost to maintain extra freight cattle and the wear of carts, etc., together with the loss of time and the trouble is greater by far than the tax imposed for the proper upkeep of the road. In fact, to compute the loss involved by bad roads would be almost impossible, both as to the shortening of life and to the reduction of the value of property—stationary, movable and perishable.

In the *Century Magazine*, for October, Mr. William Fortune gives an account of the various methods commonly in vogue in roadmaking. This article, entitled "Street-paving in America," is interesting, inasmuch as it shows the various styles and their defects.

Under the subcaptions "Foundations," "Granite or Stone Blocks," "Paving," "Wood Blocks," "Street Pavements," and "Paving Brick and their Use," there is much that can be learned and much shown to avoid. But here we are not dealing with the many ways of forming roads, but in the usefulness of asphalt, which Mr. Fortune describes under "Street Pavements." While "all plastic street pavements cannot properly be called asphalt pavements," yet any reader can see that asphalt is a substance which is specially designed for paving, more especially where "travel is comparatively light." While as yet we find asphalt paving too prone to climatic extremes, there is no doubt but that experiment and manipulation will overcome these defects. Such compositions require to be carefully handled, and it is well known how the contractor, for enhancement to his pocket, and the careless workman

sink the value. "The tendencies of the mastic composition to disintegrate in places, where the surface soon wears away," is certainly carelessness, and "the only safe assurance of durability is an adequately protected guarantee, at the time of construction, that they may be kept in good condition for a fixed period of time," is very protective against carelessness.

Where the roads are bad, perfection cannot be expected all at once. Indeed, there is hardly any road considered perfect. But there is no reason why they should not be improved. Where it is necessary to support heavy and constant traffic, as in cities, the granite blocks seem to be essential, of course, backed up by a strong foundation matrix. But where the traffic is not over-heavy or over-continuous, as in most parts of this country, an asphalt composition can be made very good for all practical purposes. Eighth avenue, in this city, is sheet-paved on both sides to the car rails, and there is a very general traffic, in some part rather heavy, yet it withstands the pressure admirably. The system of throwing down debris on the soft soil to strengthen or make a road only adds to the general unevenness. In places not yet fully built up it will be found in the end to be very much cheaper to thoroughly organize a system for the maintenance of the roads.

Pure Air.

Dr. W. H. Maxon remarks: All recognize the fact that we should have plenty of air in order to live, but it is also necessary that we have good air. Pure air is made up of nitrogen and oxygen, with some carbon dioxide and some vapors. About one fifth of this is oxygen and four-fifths nitrogen. These gases are equally distributed by currents of air all the time, so that all over the earth the air is essentially the same The vapor in the air is composed largely of water, which is necessary. A large amount of moisture in the air makes a humid atmosphere. As we inhale we breathe the oxygen into the lungs, and as we exhale we give off the carbon dioxide gas and certain animal vapors as well. By a wise provision the plants and growing vegetation use the carbon dioxide and in return throw off oxygen, which serves to keep the air in balance between oxygen and carbonic acid gas. Otherwise the air would become overburdened with carbonic acid gas, to the detriment of animal life.

It is in the lungs that the blood is purified, where it receives the oxygen and gives off the carbon dioxide. There are about 2,000 square feet of surface in the lungs, and at every breath the air loses about one cubic inch of oxygen and receives one cubic inch of carbonic acid gas in exchange. The capacity of a man of ordinary height should be about 330 cubic inches. One hundred inches of this air remain in the lungs all the time. This we call residual air, because it resides in the lungs. There are about 230 cubic inches that we can breathe in and throw off by extra effort; but, as we are breathing here this morning, we are taking in about 30 cubic inches at each breath. If I were to make an extra effort I could take in 100 more besides the 130; consequently we can take in 230 cubic inches by forced respiration. The 200 cubic inches which we can utilize by extra effort we may use in cases of emergency.

Normal air contains 2 cubic inches of carbonic acid gas to every 5,000 cubic inches of air, and 2½ cubic inches to every 5,000 cubic inches of air makes vitiated air. So it is plain to be seen that one cubic inch of carbonic acid gas extra to 5,000 cubic inches or about 3 cubic feet of air will vitiate the air and render it unfit to breathe. It therefore follows that as we throw out 1 cubic inch of carbonic acid gas at every breath, every breath will vitiate about 3 cubic feet of air, and as we breath 17 times a minute, if we multiply this by 17, and again by 60, the number of minutes to the hour, we will find that we will vitiate over 3,000 cubic feet of air every hour. Thus we can see that it is necessary that we should have a change of air very often.

Unfortunately, the ordinary bedrooms will contain about 1,000 cubic feet of air, and, in order to keep it pure, it should be changed three times an hour. A bedroom, when the dimensions are 20×15×10 feet, will contain 3,000 cubic feet of air, and needs only a complete change of air every hour to make it a wholesome sleeping room. If the carbonic acid gas is allowed to increase in the air beyond this point, it becomes deleterious to health. The carbonic acid gas is not of itself poisonous, but with it are various poisonous vapors, chiefly animal matters, consequently the amount of poison is measured by the amount of this gas.

In order to have good vitality you must have good air. If you find your head getting thick, look after the ventilation. We should have our rooms so arranged that 300 cubic feet of air can be supplied every hour. Air is vitiated when it contains 500ths of 1 one per cent. of carbonic acid gas, but when it comes to five-tenths of one per cent. it is poisonous, and can be detected by the odor. Hence, if we can detect an odor, the air is foul air. This we sometimes find in school rooms and in churches, and if we breathe such air as this, it is deleterious to health.

To make a change of air it will be necessary to have a system of ventilating shafts, or keep some of the windows and doors open. We should become accustomed to open doors and windows, especially during the warm season. It would be even better if the fresh air could be allowed to come in at the top of the room, and the foul air go out at the bottom, as there is a strong tendency towards hot heads and cold feet, which this mode of ventilating would in a measure correct.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Consumers' Gas Company, of Wilkes-Barre, Pa., has just placed an order for a second set of water gas apparatus with the Western Gas Construction Company, of Fort Wayne, Ind. The order calls for a 7-ft. 6-in. set of the Construction Company's improved Lowe apparatus. There was considerable competition for this contract.

ASSEMBLYMAN CARROLL has introduced a bill in the New Jersey Legislature which specifies that the gas rates in New Jersey cities of "the first and second class" shall not exceed $1.25 per 1,000 cubic feet. The measure is under consideration by the Assembly Committee on Municipal Corporations.

MR. W. M. PEATMAN, Secretary of the Centerville (Iowa) Light, Heat and Power Company, writing to us under the date of January 11th, says: "The Loomis gas plant which we have had in operation for the past three years, making fuel water gas, has just been changed to the Askins process, which was started on the 4th inst., and is giving the best of satisfaction. The gas furnished is of 20-candle power, and gives a very white, steady flame. The schedule of prices charged for gas is $1.25 for the first 1,000 feet, $1 for the second 1,000, 75 cents for the third 1,000, and 60 cents for all over 3,000 cubic feet. Since the change the gas-fitters and plumbers have been kept busy putting in new services, and we have already added more than 50 new consumers to our list. Centerville is located in the heart of the best coal field in the State and coal is very cheap; but regardless of this many consumers are using gas for fuel."

THE proprietors of the Chelsea (Mass.) Gas Company have sent out to the charitable fund of the Chelsea firemen a check for $50, in acknowledgment of the good work done by the firemen at the recent fire in the Company's works.

ON the 9th inst., Assembyman Whittet introduced a bill in the New York Legislature repealing the rights granted by the Legislature of last year to the Queen City Gas Company, of Buffalo. Mr. Whittet says he means to pass the repealer if possible.

AT the annual meeting of the Peoples' Gas Light Company, of Jersey City, the following officers were chosen: T. Morris Parot, President; Thomas H. Williams, Vice President; E. R. Case, Secretary.

MESSRS. DONAHUE & HENNEBERRY, a firm of Chicago printers, have instituted a suit for $75,000 damages against the Economical Fuel Gas Company, which will be tried in Circuit Court. The action grew out of the explosion and fire in the plaintiffs' building something like a year ago, said explosion having occurred while connections were being made in the basement of the building to the Economical Company's fuel gas main pipes. Plaintiffs charge that the gas connections were being made at the order of a tenant, without their consent, hence the Company's liability. Negotiations looking toward the settlement of the dispute had been under consideration, but no compromise could be effected.

THE proprietors of the Owosso (Mich.) Gas Company will construct, this season a gasholder rated to store 75,000 cubic feet.

MR. SAMUEL R. PULLEN, a prominent resident of White Plains, N. Y., and largely interested in the Citizens Gas and Electric Light Company of that place, died on the 12th inst. He was in his 81st year.

WE understand that Mr. S. Frank Alden, of New Bedford, Mass., has been appointed Manager of the Kingston (N. Y.) Gas Company.

THE following new schedule of selling rates for coke has been made public by the Altoona (Pa.) Gas Company:

Sort of Product.	Old Rate.	New Rate.
Crushed coke, delivered	8 cents per bush.	6 cents per bush.
" at works	6 " "	5 " "
Uncrushed coke, delivered	6 " "	5 " "
" at works.	5 " "	4 " "

THE trial car on the New York and Brooklyn Bridge, that has been lighted by the Pintsch system, has proved so satisfactory that it is only a question of a short time when all the coaches will be lighted by compressed gas.

THE Berlin Iron Bridge Company, of East Berlin, Conn., is putting the roof on a building for the United States Government, at Fort Wadsworth, N. Y. The building is 41 feet wide and 231 feet long, the roof being entirely of iron—iron trusses covered with corrugated iron.

MAJOR S. W. SYMINGTON, Superintendent of Lamps, Baltimore, Md., in his annual report to the Mayor, shows that there are now 1,031 arc electric lights, 4,946 gas lamps, and 518 gasoline lamps in the city proper, and in the Annex, 623 gas, 547 gasoline, and 4 electric arc lamps. Many more gas lamps are needed in the city, and he complains that the force of lamplighters is insufficient. He asserts that the Gas Company laid no additional mains during the year, and avers that the service of the electric lamps is not all that it should be. The oval globe is taking the place of the old square lantern. He asks that the duty of inspecting meters be taken from his office, giving as his reason therefor that it takes up too much time, and is important enough to warrant its being done by a separate department. The cost of public lighting is divided as follows: Electric lights, $124,176.78, or $4,823.21 less than the sum appropriated; gas, $141,886.94, or $11,886.94 in excess of the sum appropriated; and gasoline, $6,119.35. In the Annex, for electric lights, $481.70; gas, $17,908.60; gasoline, $6,817.13. The estimate of requirements for the current year is: Electric lights, $138,289.75; gas, $147,098.75; gasoline, $6,580; lamplighters, $49,500; total, $339,468.50. Annex, electric lights, $1,277.50; gas, $18,840; gasoline, $6,870; lamplighters, $13,500; total, $40,487.50. Grand total for city and Annex, $379,956.

AT the annual meeting of the stockholders of the Hackensack (N. J.) Gas Light Company the following Directors were elected: George W. Conklin, John O. Grode, Chas. E. Lydecker, C. Zabriskie, Wallace Dunbar, D. W. Chamberlain and Frank B. Poor. It will be noted that this list does not contain the name of Mr. E. E. Poor, who, with his son, formerly held a controlling interest in the shares.

MAYOR TIEPKE, of Pawtucket, R. I., in his annual message to the local legislators, thus refers to the street lighting department of the city: "This department renders important service to the city, and the people are continually demanding the extension of the street lighting service. I am led to the belief from observation and experience that action on a petition for a street light is not always determined by sound judgment. The report of the Superintendent of Street Lights shows that during the year the expenditures amounted to $28,372.83, and that there are now in use 50 full arc lights 2,000 candle power (all night service) costing $150 each per annum; 137 arc lights (half power burning until 1 o'clock) at $85 each per annum. He estimated tha t$32,000, being an amount equal to that appropriated in 1893, will be required to maintain this department. I have caused to be prepared a map locating the electric street lights now in use, and I request that the joint standing committee on street lights examine the same with a view of securing a discontinuance of lights not actually needed thus reducing the cost of maintaining this department. I also believe that by a rearrangement of the remaining lights improved service can be secured in many parts of the city. At least 25 lights can be discontinued by careful examination of the present location thereof and a proper rearrangement of the same. It is sometimes stated by representative manufacturers, who own and operate electric lighting plants in the production of a factory illuminant, that the city ought to purchase and install a municipal electric lighting plant, and thus secure its electric lights at first cost. The mere fact, however, that private ownership of electric lighting plants in factories has proved both profitable and economical to the manufacturers (which experience furnishes the sole argument of some of the advocates of the plan) does not establish by any means either the wisdom or the practical economy of establishing at once, and without discussion, a municipal lighting plant to be operated and controlled by public officials who are clothed with an uncertain tenure of office, nor does it destroy the potency of the argument that the electric light service in factories, both in regard to the cost of production and maintenance, and the character of the equipment required, is a totally different matter in its details from that involved in the production of electric lights for street lighting, nor does it abate the constantly growing sentiment which is demanding that electric light, as well as all other wires, shall go underground. The whole problem is quite as important and perplexing in its many details as any which is before the people, and is worthy of careful examination; but the present condition of our municipal indebtedness furnishes a powerful argument against the discussion of the proposition, and virtually prevents its consideration at that time. In addition to the present indebtedness, which has assumed large proportions, the qualified electors have already voted in favor of the erection of a City Hall and the establishment of a public park, and at the first favorable opportunity their wishes must certainly be obeyed and executed. I am of the opinion that the appropriation for the street light department should be materially reduced."

ATTENTION is called to the advertisement inserted by the Citizens' Gas Company, of Buffalo, N. Y., under which the Company asks for bids for the tar produced on the works for the year ending March 15th, 1895. The estimated product is put at 3,500 barrels. All bids should be forwarded to Peter P. Miller, Secretary and Treasurer, and the competition will close on March 15th.

THE new works of the Stanley Electric Manufacturing Company, at Pittsfield, Mass., will be entirely of iron, from designs furnished by the Berlin Iron Bridge Company, of East Berlin, Conn., which concern will also put up the buildings.

IN the last issue reference was made to injunction proceedings argued before Judge Gunster which concerned the city of Scranton, Pa., and the Scranton Gas and Water Company. The Judge in deciding the cases declared he did not think the reasons advanced were sufficient to warrant him in making the injunctions permanent.

THE Oberlin (Ohio) Gas and Electric Company has filed a certificate of increase of its capital stock from $20,000 to $30,000.

MR. EDWARD F. SHERMAN, son of Mr. F. C. Sherman, of the New Haven (Conn.) Gas Light Company, has been appointed Superintendent of the East Portland (Oregon) Gas Company.

AT the annual meeting of the Newport (R. I.) Gas Light Company the following officers were elected: Directors, Messrs. Henry Bull, James C. Swan, Philip Rider, Thomas A. Lawton, Andrew K. Quinn, President, Henry Bull; Secretary, Thomas A. Lawton; Treasurer, Andrew K. Quinn.

THE holder station at Catonsville, which is being constructed for the better gas supply of that district by the Consolidated Gas Company, of Baltimore, Md., will be conpleted in a month.

THE proprietors of the Gettysburg (Pa.) Gas Company have declared a dividend of three per cent., payable out of the earnings of the last six months.

EMANUEL H. LEMON and his wife, Eva Lemon, have brought a damage suit in the sum of $3,000 against the Mutual Gas Saving Company, of Baltimore, Md. The complaint alleges that the Company places governors on gas meters to decrease the gas pressure, and that the governor placed upon the plaintiff's meter caused a leakage of gas which rendered Mrs. Lemon unconscious.

THE contract for the erection of a new gas plant for the West Side Gas Company, of Kingston, Pa., which proposes to supply gas to the residents of Kingston, Forty Fort, Edwardsville and other villages close to Wilkes-Barre, Pa., has been awarded to Mr. A. J. Roat. He in turn has authorized the Economical Gas Apparatus Construction Company, Limited, of Toronto, to supply him with a No. 1 Merrifield-Westcott-Pearson setting of improved water gas apparatus, which Company controls the patents for the process named. The Economical Company will also furnish the necessary holder connections, etc.

THE bursting of a fly wheel in the Edison electric light plant, at West Chester, Pa., caused a temporary interruption to the lighting of that place, on the evening of the 13th inst. Considerable damage was done, but the duplicate engine was unharmed, and the lighting was speedily resumed. In 1887 these works were wrecked by a boiler explosion, in which disaster several lives were lost.

AT the annual meeting of the Chicago Gas Light and Coke Company the following officers were chosen: Directors, E. J. Jerzmanowski, E. C. Benedict, F. S. Hastings, Walton Furguson, A. N. Brady, F. S. Winston, W. J. Campell, George O. Knapp, C. K. Wooster, C. K. G. Billings, and L. A. Wiley; President, E. J. Jerzmanowski; First Vice-President, C. K. G. Billings; Second Vice-President, George O. Knapp; Secretary and Treasurer, C. K. Wooster; Assistant Secretary and Treasurer, L. A. Wiley.

AN explosion is reported to have occurred, on the night of the 12th inst., in the valve house of the Malden and Melrose (Mass.) Gas Light Company. The trouble occurred from an escape of gas that was ignited by a lantern in the hands of the night watchman, Patrick Barrett, who was severely burned.

AT a meeting of the Cleveland (O.) Council, a feature of the proceedings was the reading of the following report from the special committee (Messrs. Jackson, Straus, O'Brien, Herbert and Barrett) appointed to consider the subject of electric lighting: "Your committee, appointed to investigate the complaints of consumers of electric light that they were being overcharged by the electric light company, beg leave to report as follows: Consumers of electric light have appeared before your committee and testified that since the electric light company has adopted meters for measuring the quantity of electric light used by consumers the price has increased from 200 to 300, and in some cases 400 and 500 per cent. Your committee further finds that complaint has been made to the electric light company by large consumers that the price charged was exorbitant; that the company has made special arrangements with such complaining consumers and allowed them to use electric light at the old rate, or at the same rates that were charged before the meters were put in. Your committee further finds, from the evidence submitted by expert electricians, that were the plant constructed under the latest improved methods electricity could easily be furnished to the consumers at the price of 7 cents per 1,000 watt hours, but that the General Electric Light Company's plant is constructed in such manner that a reasonable and fair price would be 9 cents per 1,000 watt hours, which price your committee recommends they may be permitted by ordinance to charge. But this electric lighting question is one of such importance that your committee feels called upon to suggest that it would be proper for the city to own its own electric plant. Testimony of expert electricians has been submitted to your committee, from which we find that it would be possible and proper for the city, at a cost of $600,000, or $750,000 at the most, to erect a plant which would supply arc lights upon every street intersection of the city, and about 15,000 incandescent lights, at a cost of 7 cents per 1,000 watt hours to the city and consumers, and pay such dividends upon the investment as to make the plant pay for itself in 15 to 20 years. Your committee therefore recommends that the Corporation Counsel be instructed to draft a bill to be submitted to the Legislature, requesting authority for the city to issue bonds in the sum not exceeding $750,000 for the purpose of establishing a public electric lighting plant," The report was referred to the Director of Law, with the request that he draw up ordinances and resolutions in accordance with the suggestions of the committee, the findings to be submitted to Council at a future meetiug.

THE Freehold (N. J.) Gas Company has declared a semi annual dividend of 3 per cent. on the capital stock. The dividend also covers the investment made on account of the Company's electric lighting plant.

THE Waterloo (N. Y.) Electric Light Company has submitted a proposition to light the streets for a term of five years, with not less than 50 arc lamps of 2,000-candle power, "warranted," on the basis of a moon table, each arc to be paid for at the rate of $60 per annum.

AT the annual meeting of the Williamsport (Pa.) Gas Company, the following officers were chosen: Directors, B. C. Bowman, H. Mudge, John J. Reading, R. C. Reading, H. H. Pigott, John F. Laedlin and John M. Dean; President and Superintendent, R. C. Reading; Secretary and Treasurer, George E. Rentz; Assistant Superintendent, M. J. Winters.

THE Philadelphia *Record* says: "Dollar gas will soon be an established fact. Beginning on Monday, January 15th, all consumers of gas in the city, with the exception of those supplied by the Northern Liberties Gas Company, in the northeastern section, will be furnished with the illuminant at one-third less price than they have been paying. Since the 8th inst. the meter inspectors of the Gas Bureau have been hustling about town obtaining statements from the meters in the various dwelling and business houses of the city in order to have the dollar gas ordinance go into effect as soon as possible. There are in the entire city 165,000 gas meters in buildings supplied with gas by the municipality. The Gas Bureau has 45 meter inspectors, so that since the 8th inst., when the Bureau started in to get the figures of gas consumption under the old rate, in order to begin the dollar gas era, each inspector has examined and obtained figures from an average of about 4,000 meters. The men have worked night and day, and their tasks were finished up on the evening of the 13th inst. Up to the present time there has been no appreciable increase in the consumption of gas since the reduction went into effect. Director Windrim does not look for any great spurt until the people get used to the idea that they can burn at least one-third more gas than they have been accustomed to using, without additional expense. Statistics of the Gas Bureau show that the average daily consumption at this season for several years past has been about 16,000,000 cubic feet. At present it is about 15,000,000. The decrease is presumably due to the financial depression and the consequent closing of a number of manufacturing establishments. Chief Park, of the Gas Bureau, has personally supervised the work which has been done at all the city's gas plants with a view to increasing the facilities for supply, and on January 12th he reported to Director Windrim that everything was in readiness to distribute one third more than the quantity that had been distributed daily for the past two months. The Director is of the opinion that the works will be found fully equal to all demands for increased consumption that may be made upon them between now and the time when permanent improvements can be made."

MR. MARRIN has introduced a bill in the New York Legislature which provides that the price of gas in the annexed district of New York city shall not exceed $1.25 per 1,000 cubic feet. This bill was a "feature" of last year's legislative proceedings.

CERTAIN residents of the Dorchester district of Boston have petitioned the Board of Gas and Electric Light Commissioners for a decree ordering a reduction in the rate charged for gas by the Dorchester Gas Company.

THE Directors chosen by the Hartford City (Conn.) Gas Light Company for the ensuing year are Messrs. Hugh Harbison, Francis B. Cooley, James L. Howard, Henry K. Morgan, George S. Roberts, John P. Harbison, Atwood Collins, Nathaniel Shipman and Rodney Dennis.

THE officers chosen by the Lancaster (Pa.) Gas Light and Fuel Company are: Directors, Henry Baumgardner, H. M. North, H. C. Demuth, Thomas Baumgardner, N. M. Woods, J. H. Wichersham and J. J. Hartman; President, Henry Baumgardner; Secretary and Treasurer, J. H. Baumgardner.

MORE trouble seems to have overtaken the Standard Gas and Electric Light Company, of Huntington, L. I. As was said by us some time ago, the plant was put in practical operation late in December, but the period of activity was short, for gas making was stopped by Engineer Leadley, through the failure of the Company to satisfy a claim which he holds against it.

SUPERINTENDENT ADAMS, of the Richmond (Va.) Municipal Gas Works, hopes to be able to convince the authorities that the plant would be greatly benefitted were the purifying houses enlarged to the degree which would enable them to be operated economically. He also favors the plan of supplying gas to the town of Manchester, opposite Richmond, on the South bank of the James river. The supply could easily be carried on by means of a main carried across Mayo's bridge.

MR. ANDREW W. DE FORREST, who has been acting President of the New Haven (Conn.) Gas Light Company since the death of Mr. Daniel Trowbridge, was formally chosen President at the annual meeting held about a fortnight ago. The other officers are: Vice-President, Pierce N. Welch; Secretary, Gardner Morse, Jr.; Tresurer, Isaac J. Wild; Superintendent, F. C. Sherman.

THE Worcester (Mass.) *Spy* says that the Superintendent of Street Lighting, Mr. Henry A. Knight, in his annual report for 1893, notes that the extent of the territory covered and hours of service have been increased, extensive repairs have been made on the gas and gasoline lanterns, contracts have been closed for electric lighting at a material reduction from former prices, and a movement inaugurated which, it is hoped, will result in cheaper gas to the city. The Superintendent complains of two obstacles met with in an endeavor to keep the streets lighted with uniform brilliancy, the crooked character of the streets and the condition of the trees, and suggests that while former objection cannot be remedied, the latter can by judicious trimming and lopping off bothersome branches. The total number of lights in charge of the department, November 30th, 1893, was 2,469, of which 410 were arc lights, 26 were incandescent lamps, 248 were gas lamps, 1,744 were gasoline lamps, and 39 were police signals. This is an increase of 48 arcs and 15 incandescents, and a decrease of 29 gas and 31 gasoline lights over the number for 1892. Mr. Knight's opinion is that an incandescent lamp of low candle power might be successfully used on the police signals. As the signal lamps are now located, they are of but little use or value in lighting the city.

AT the annual meeting of the Dover (N. H.) Gas Light Company the Directors chosen were: Messrs. E. V. Brewster, T. B. Garland and Amos Paul, and the Directors organized by naming the following executives: President, E. V. Brewster; Treasurer, T. B. Garland.

WE continue to receive reports of decreased sendout from points all over the country.

The Market for Gas Securities.

Consolidated held remarkably steady during the week, with a seeming tendency toward higher prices, the opening to day (Friday) having been made at 125½ bid, offered at 127. There is still some uncertainty respecting the attitude of the present Legislature towards insisting on a dollar gas rate for New York and Brooklyn, although the belief still grows that no such bill will be enacted this season. The thing cannot well be made a party measure, and in any event the republicans do not seem as anxious as they were to unseat a sufficient number of their opponents to secure a two-thirds vote. The Governor is not inclined to favor any measure harrassing the gas interests of the State; and, take it all in-all, we do not think the rate will be altered this year.

Mutual gas is quite strong, 100 shares of same having been offered at auction this week, but no sale was made, the upset price not having been reached, although the last bid made was 149. Equitable is practically unchanged. Sales at auction included 232 shares Consolidated, at 125½; 100 Standard preferred, at 75; 71 shares Equitable, at 180½; 35 shares Central, at 75.

Brooklyn shares are at last quotations, and nothing has as yet come out of Mr. Orr's invitation for a conference. Chicago gas held up well for the week. The opening price to day was 65½ to 65¼. Bay State moved up sharply to 17 and 17½, and Baltimore Consolidated was in brisk demand, at 54½ to 55.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

January 22.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	125½	127
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	187	190
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	108	112
Mutual	3,500,000	100	144	147x
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	80	95
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	50	65
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	—	32
Preferred	5,000,000	100	—	77
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	115
Citizens	1,200,000	20	57	—
" S. F. Bonds	320,000	1000	—	101
Equity Gas Light Co	2,000,000	100	—	—
Bonds	1,000,000	—	25	40
Fulton Municipal	3,000,000	100	130	—
" Bonds	300,000		113	—
Peoples	1,000,000	10	80	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	98	100
Metropolitan	870,000	100	—	140
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	145	—
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Bay State Gas Co.—				
Stock	5,000,000	50	17	17½
Income Bonds	2,000,000	1000	40	—
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	78	—
2d " " "	3,000,000	1000	57	58
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company.	25,000,000	100	65⅝	65¼
Chicago Gas Light. & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	81⅛	81½
Consumers Gas Light Co., Jersey City	2,000,000	100	25	—
Bonds	600,000	1000	83	—
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	184½	187
Central, S. F., Cal			—	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt	11,000,000	100	54¼	55
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
1st Mortgage			56	—
East River Gas Co., Long Island City	1,000,000	100	—	—
Bonds	500,000	100	89¼	—
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
Hartford, Conn	750,000	25	120	128
Jersey City	750,000	20	190	200
Louisville, Ky	2,570,000	50	125	130
Laclede Gas Light Co. St. Louis, Mo.—				
Common Stock	7,500,000	100	15½	16
Preferred "	2,500,000	100	66	70
Bonds	9,034,400	1000	83½	84

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It takes but little room. It requires no change to be made in the height or depth of gas houses.

It is simpler and easier operated. It makes *more good gas from a given quantity of stock.* It makes good gas from *cheaper stock.* It makes gas of *any desired candle power* up to thirty without smoke. It makes a faultless gas from whatever gas-producing materials are cheapest in the locality where required, using hard coal or coke in connection with Lima crude or any other crude petroleum or its distillates, including *naphtha of any specific gravity.*

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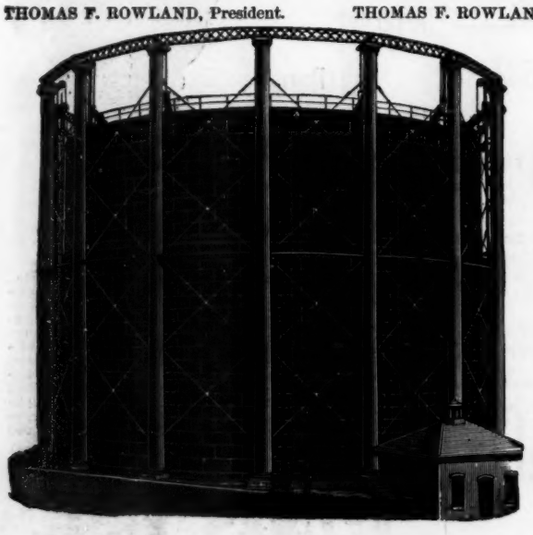

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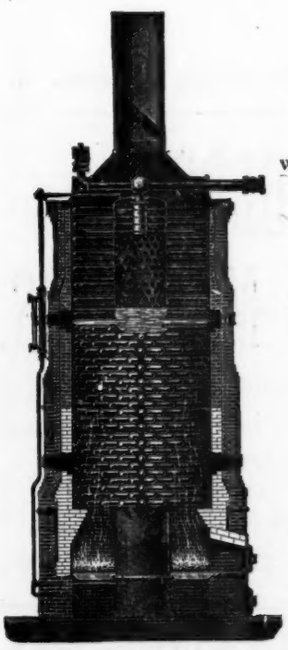

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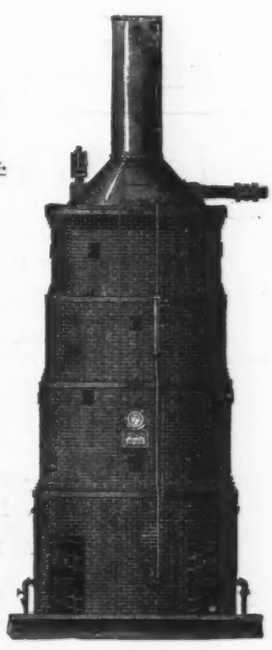

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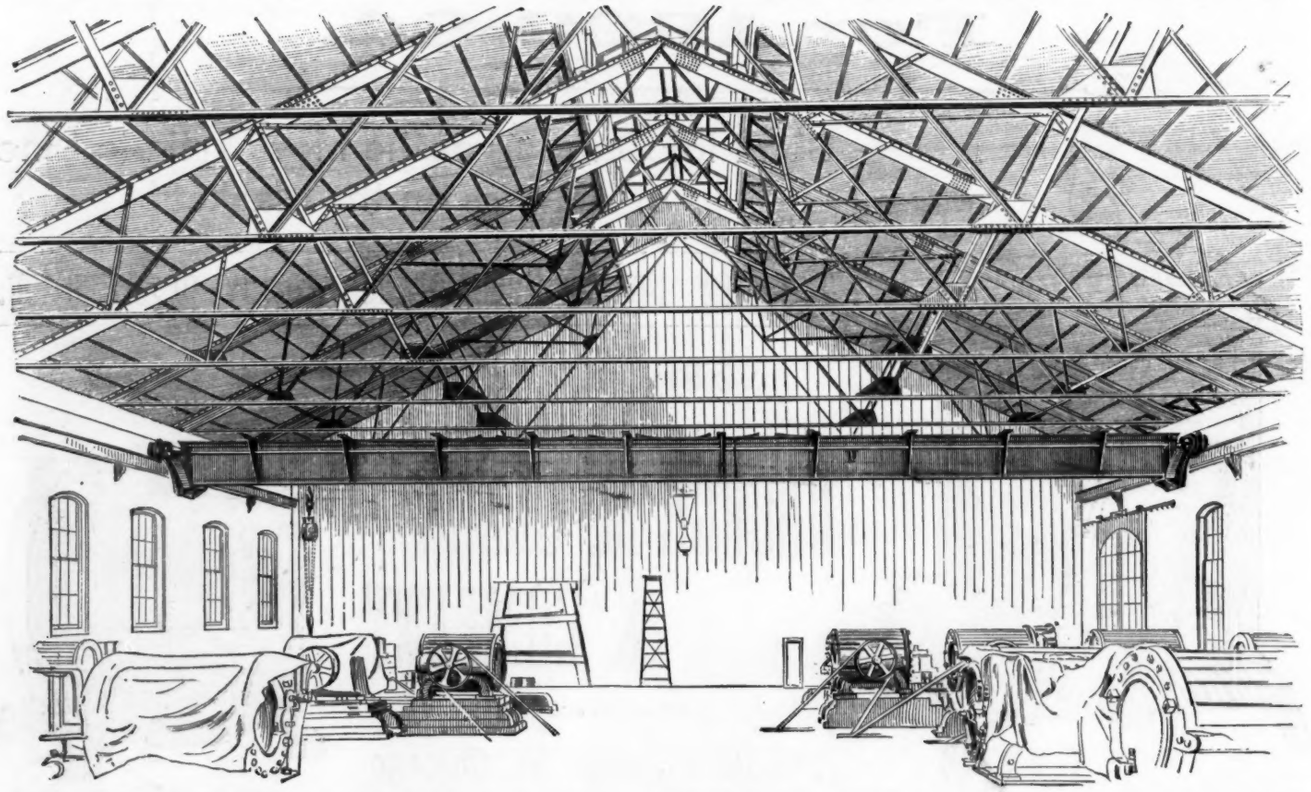

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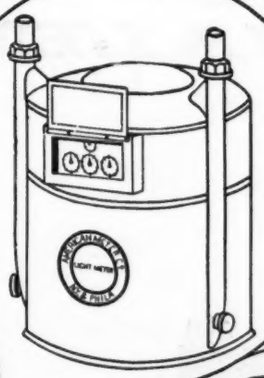

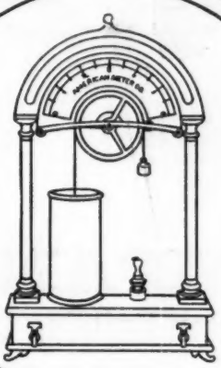

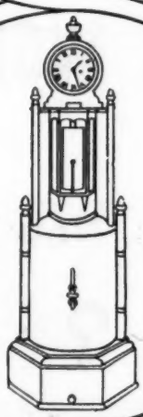

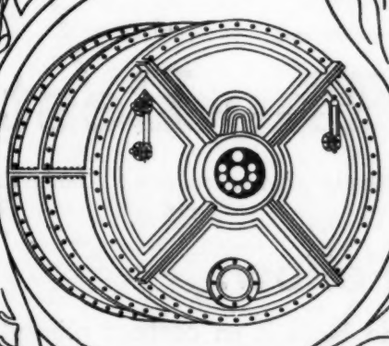

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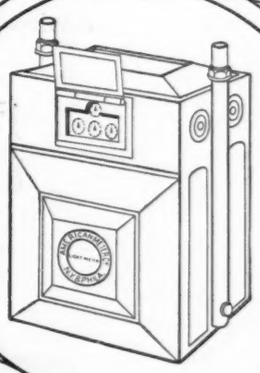
PUBLIC LIGHTING TABLE.

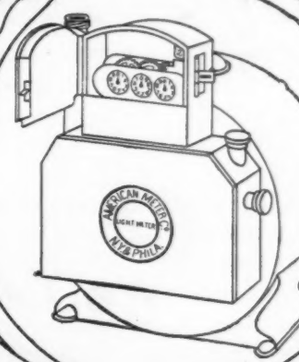
FEBRUARY, 1894.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Thu.	1	5.50 PM	6.10 AM	5.05	6.15
Fri.	2	5.50	6.10	5.05	6.15
Sat.	3	5.50	6.10	5.05	6.15
Sun.	4	5.50	6.10	5.05	6.15
Mon.	5	5.50 NM	6.10	5.10	6.10
Tue.	6	5.50	6.00	5.10	6.10
Wed.	7	6.00	6.00	5.10	6.10
Thu.	8	6.00	6.00	5.10	6.10
Fri.	9	6.00	6.00	5.10	6.10
Sat.	10	9.40	6.00	5.10	6.10
Sun.	11	10.40	6.00	5.10	6.10
Mon.	12	12.00	6.00	5.20	5.55
Tue.	13	1.10 AM FQ	6.00	5.20	5.55
Wed.	14	2.20	5.50	5.20	5.55
Thu.	15	3.30	5.50	5.20	5.55
Fri.	16	4.30	5.50	5.20	5.55
Sat.	17	No L.	No L.	5.20	5.55
Sun.	18	No L.	No L.	5.20	5.55
Mon.	19	No L. FM	No L.	5.30	5.55
Tue.	20	6.10 PM	7.30 PM	5.30	5.55
Wed.	21	6.10	8.40	5.30	5.55
Thu.	22	6.10	9.50	5.30	5.55
Fri.	23	6.10	11.00	5.30	5.55
Sat.	24	6.20	12.10 AM	5.30	5.55
Sun.	25	6.20	1.10	5.30	5.55
Mon.	26	6.20	2.20	5.30	5.45
Tue.	27	6.20 LQ	3.20	5.30	5.45
Wed.	28	6.20	4.10	5.30	5.45

TOTAL HOURS LIGHTING DURING 1894.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	244.10	January	423.20
February	195.30	February	355.25
March	206.20	March	355.35
April	169.40	April	298.50
May	162.10	May	264.50
June	135.40	June	234.25
July	146.30	July	243.45
August	162.20	August	280.25
September	174.10	September	321.15
October	211.20	October	374.30
November	221.00	November	401.40
December	245.30	December	433.45
Total	2274.20	Total	3987.45





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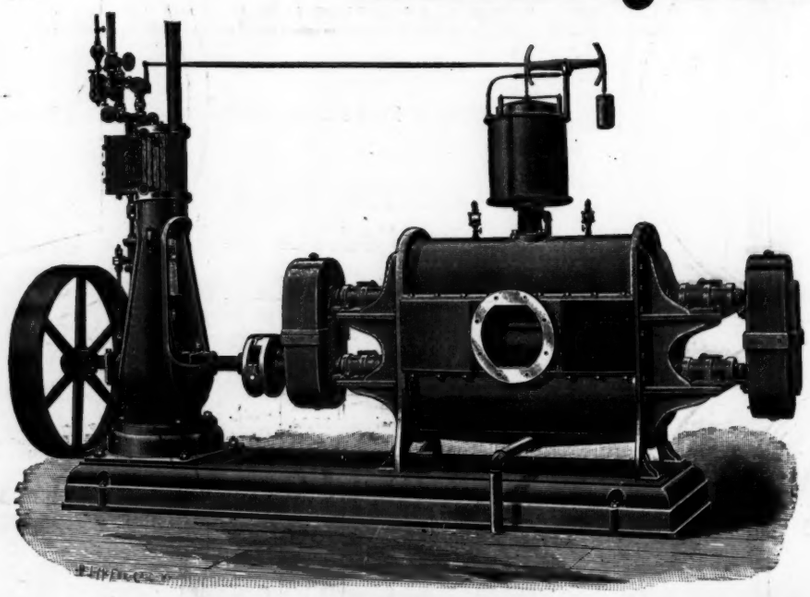

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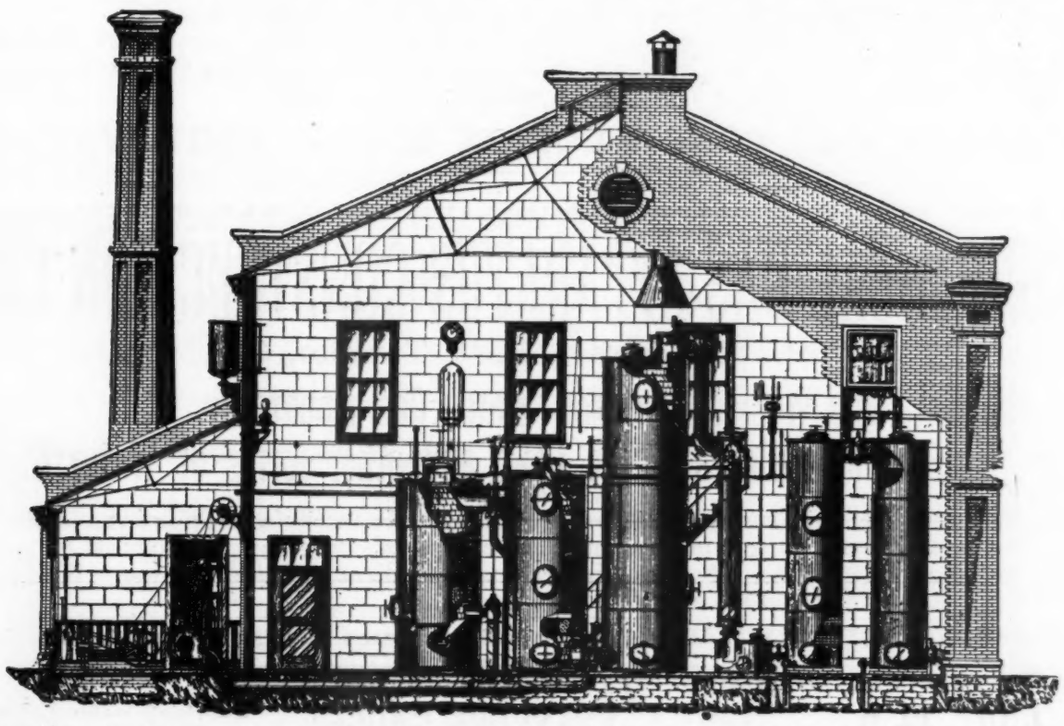

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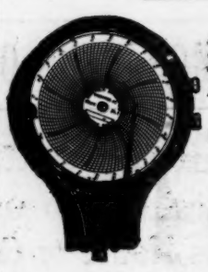

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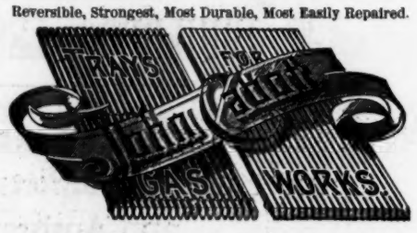

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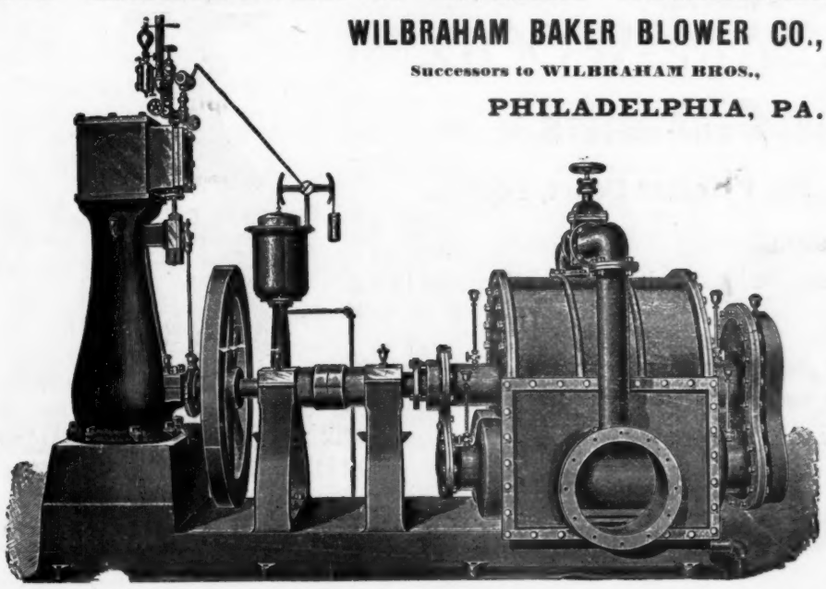

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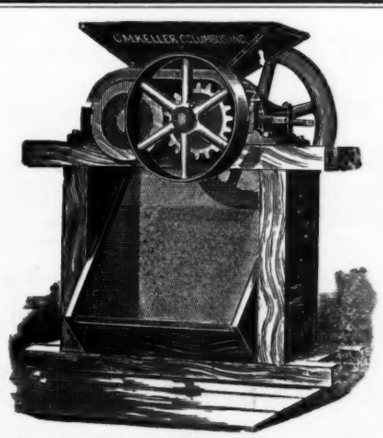

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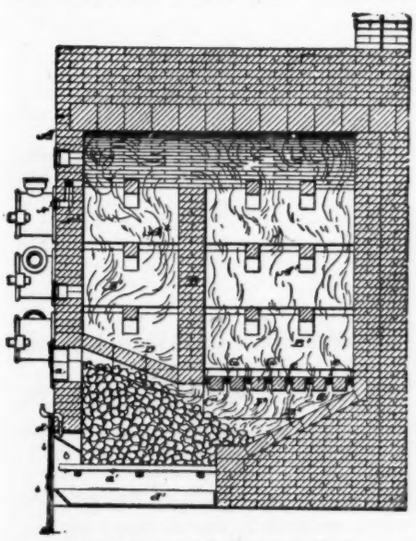

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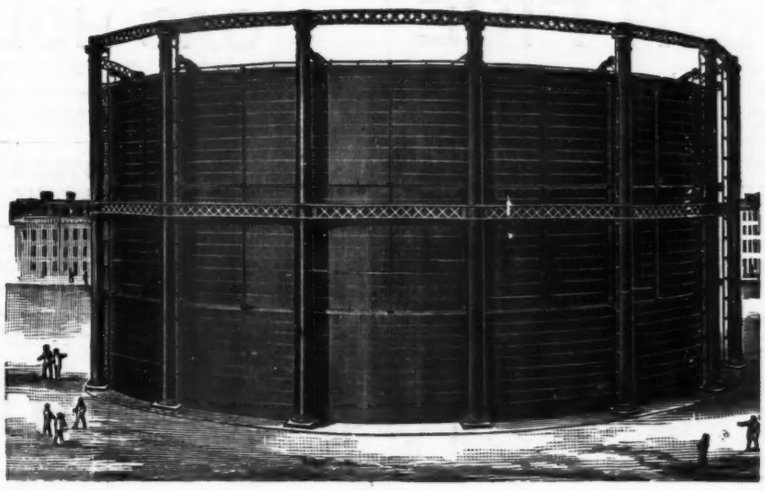

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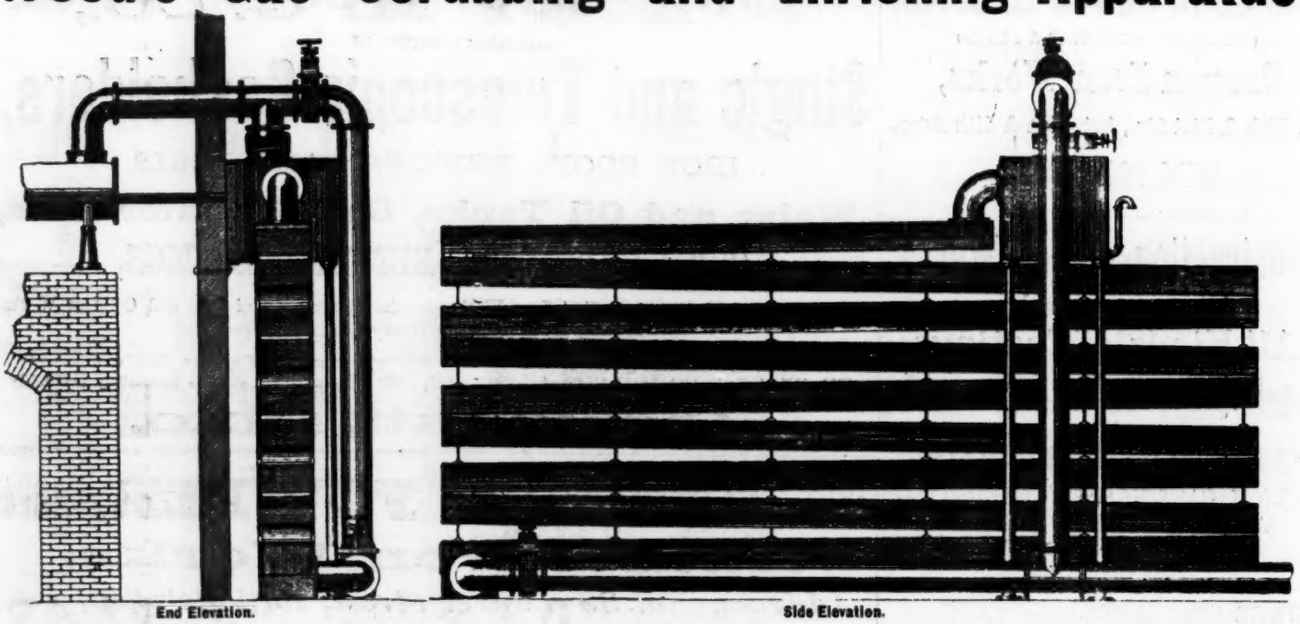

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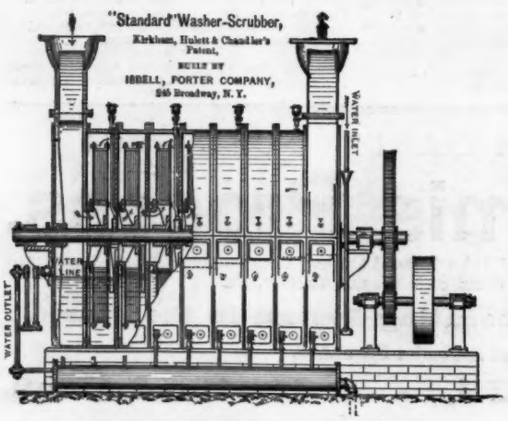

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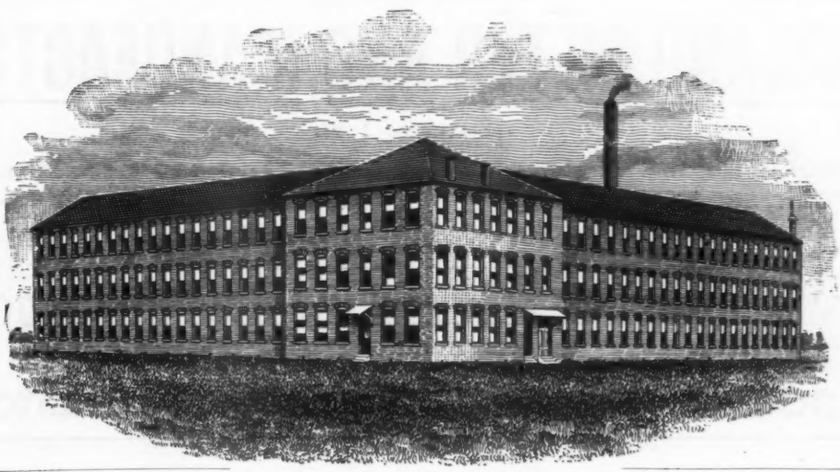

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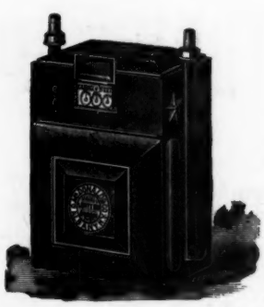

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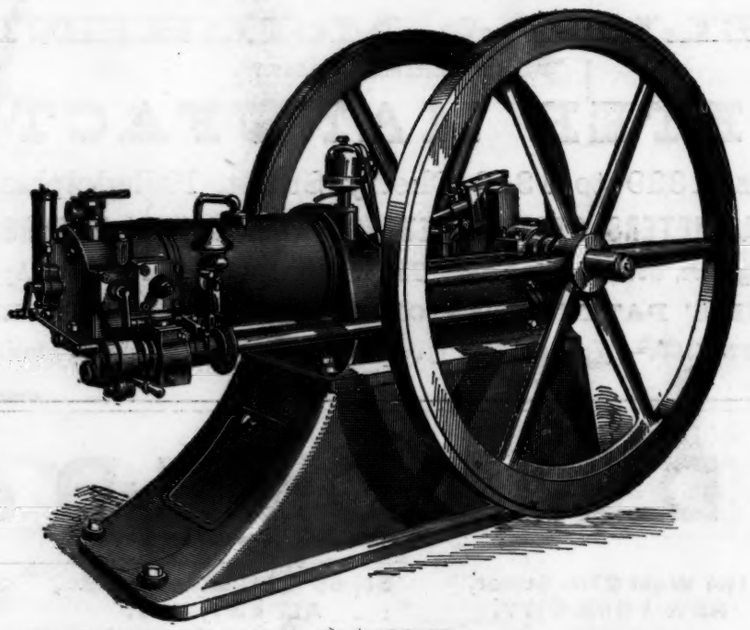

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